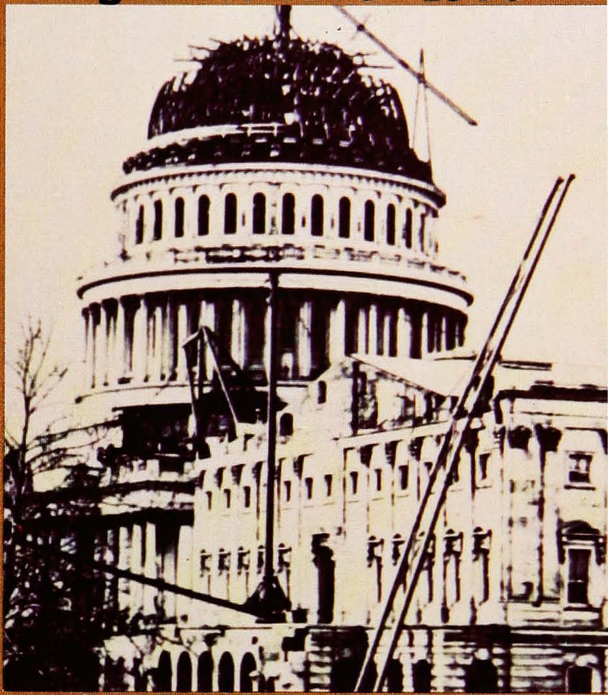
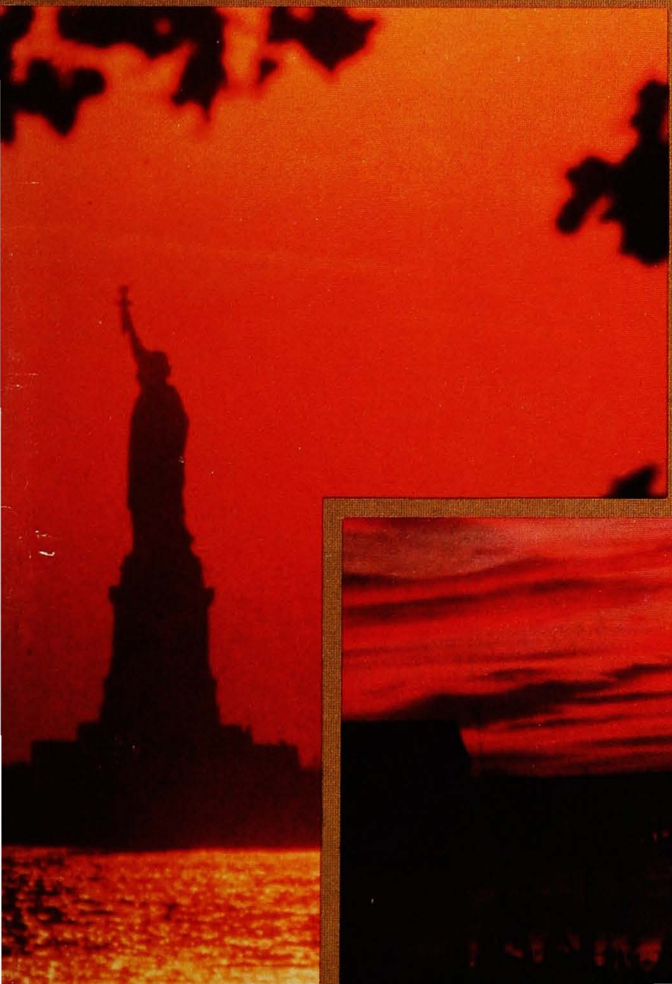
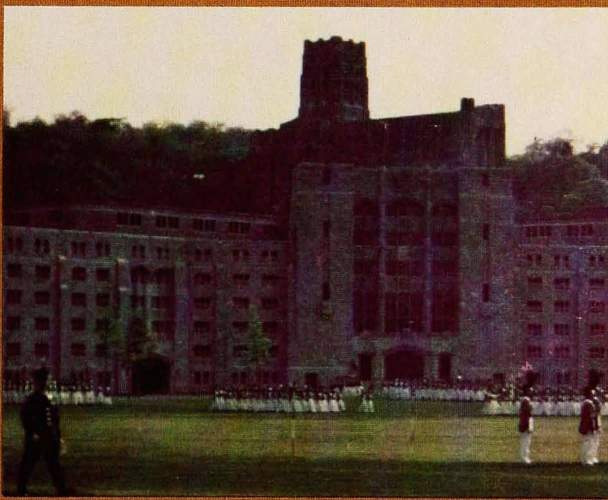
A History of the North Atlantic Division and its Predecessors in the U.S. Army Corps of Engineers 1775 - 1975

The North Atlantic Engineers







Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE **1980**	2. REPORT TYPE	3. DATES COVERED **00-00-1980 to 00-00-1980**

4. TITLE AND SUBTITLE **The North Atlantic Engineers: A History of the North Atlantic Division and its Predecessors in the U.S. Army Corps of Engineers 1775 - 1975**	5a. CONTRACT NUMBER 5b. GRANT NUMBER 5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER 5e. TASK NUMBER 5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U.S. Army Corps of Engineers,North Atlantic Division,302 General Lee Avenue,Brooklyn,NY,11252**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S) 11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**185**	

The North Atlantic Engineers

A History of the North Atlantic Division and its Predecessors in the U.S. Army Corps of Engineers 1775 — 1975

by

John Whiteclay Chambers II

New York

North Atlantic Division

U.S. Army Corps of Engineers

1980

Library of Congress Catalog Number: 80-600164

To the memory of
Charles and Helen Frankel

FOREWORD BY THE DIVISION ENGINEER

Maj. Gen. Bennett L. Lewis

The U.S. Army Corps of Engineers has played a vital role in the development of our Nation, dating back to the Revolutionary War. Though much of the early Corps work was for national defense, the Corps also assisted in private and public efforts to develop the Nation's transportation system. The assistance of Army engineers in construction of communications networks — roads, railroads, canals, and navigation channels — was an important influence on the economic development of the Nation.

Throughout the years the Corps has performed military construction, been assigned responsibility for water navigation, flood control, water resources management and the unique mission of providing drinking water for the City of Washington, DC.

The North Atlantic Division, with an illustrious record of past accomplishments, looks to future opportunities to serve our Nation.

THE AUTHOR

John Whiteclay Chambers II is an Assistant Professor of History at Barnard College, Columbia University. He has written *The Tyranny of Change: America in the Progressive Era, 1900-1917* and *Draftees or Volunteers: A Documentary History of the Debate over Military Conscription in the United States, 1787-1973* and is the editor of several other books. His articles and reviews have appeared in *The American Historical Review, The Journal of American History, The American Heritage Magazine, Labor History, The American West Magazine, The Dictionary of American Biography, Political Science Quarterly* and *Dictionary of American History*. He served as director of research for the educational television series *In Pursuit of Liberty* with Charles Frankel which was shown on the Public Broadcasting System in September 1977 and January 1978. He has been a consultant for the Judiciary Committee of the U.S. House of Representatives, the National Commission on the Records and Documents of Federal Officials, and the American Museum of Natural History.

CONTENTS

CHAPTER	PAGE
Foreword by the Division Engineer	iii
Author's Preface	vi
Introduction	ix
1. Early Years of the Army Engineers in the Northeast, 1775-1888	1
2. The Division Emerges, 1888-1920	25
3. New Responsibilities: Flood Control and Other Missions, 1920-1940	43
4. Across the Seas: The Whirlwind of World War II, 1940-1945	61
5. Defending American Security in the Cold War Era, 1945-1975	85
6. Expanding Traditional Civil Works Activities, 1945-1975	103
7. Meeting New Challenges, 1960-1975	123
Footnotes	139
Bibliography	147
Index	151

AUTHOR'S PREFACE

A compelling saga of people, the environment, and national defense, this history covers the first two hundred years of the Army Engineers in the northeastern United States. It focuses on the North Atlantic Division and its predecessors between 1775 and 1975.

The exploits of the Corps of Engineers in peace and war weave into the thread of American history. From the early years of the Republic, Army Engineers performed both military and civil tasks. They helped to achieve victory in the Nation's wars and to protect its seaports against enemy attack. Yet, they also became increasingly involved in supporting economic growth, providing protection against the ravages of natural disasters, sustaining the environment, and enhancing the quality of life.

Commissioned by the North Atlantic Division, this study offers a concise history of the organization for its members and for the public that it serves. However, scholars as well as general readers can benefit from such an official history for it provides significant new data about organizational development and the adaptation of national institutions.

Organizational theory seeks to establish broad explanations for the ways in which formal structures achieve their goals and respond to demands for change. This history of the Army Engineers in the Northeast demonstrates how one such organization responded successfully to dramatic alterations in warfare, engineering, and American society as the country changed from a rural, agrarian land to an urban, industrial nation.

The organization's goals varied over time, in response to shifting needs. It modified its structure, policies and procedures to achieve those goals.

An examination of a middle-level regional agency within a substantial national institution, this study contains particularly interesting and useful information. It shows how a national organization like the Corps of Engineers linked local needs and conditions to central direction and assistance through a multi-tiered organizational structure. This successful connection offers valuable insights into one manner in which American institutions have dealt with the problem of serving a geographically and culturally diverse population. Recently, historians have applied organizational theory to demonstrate how the forces of industrialization and nationalism in the late 19th and early 20th centuries led to the creation or modification of such local-national associations to manage the change effectively. The Corps of Engineers sought to deal with these forces by establishing a system of local Engineer Districts in the 1860s and regional Engineer Divisions, like the North Atlantic Division, in the 1880s. The formation and activity of the North Atlantic Division provide a case study of the development and adaptation of the organization to the new conditions of an industrial nation and world power.

This history of the North Atlantic Division also fills a gap in the institution's memory. Previously, the only link to the organization's past had been the old-timers who handed down tales of bygone days to younger and more recent employees. But their knowledge seldom exceeded forty years with the organization and their memories often proved hazy. In time, they retired and took their knowledge with them. The history reconstructed in this volume is based upon the records of the North Atlantic Division and its predecessors as well as the recollections of dozens of people who have served in the unit. It offers a more accurate narrative of the origins and development of the North Atlantic Division, illuminating the changing size, shape, function and leadership of the organization. It seeks to provide an understanding of the background of the present and a sense of continuity with the past.

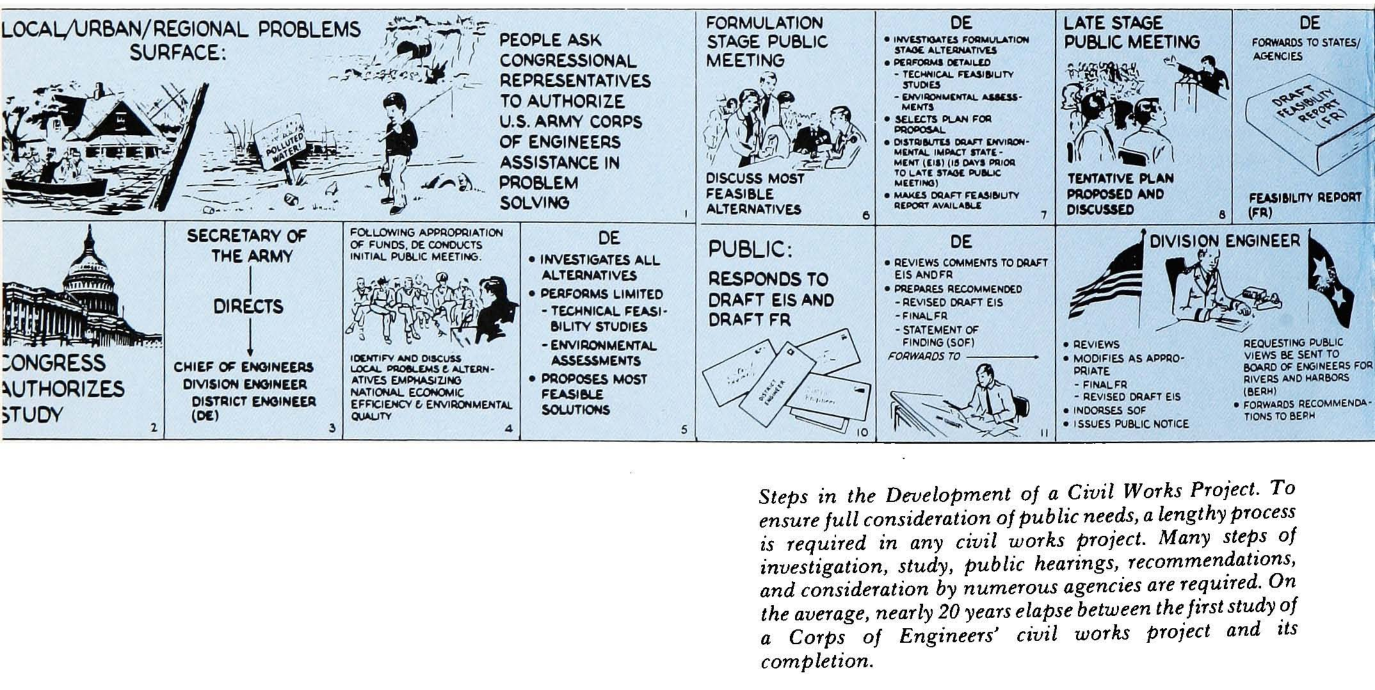
In the preparation of this volume, I have received the assistance of a number of persons to whom I gratefully extend my appreciation. The late Major General S. D. Sturgis, Jr., former Chief of Engineers, ordered each Division and District to have its history written. This enormous project has been coordinated by the Historical Division of the Office of the Chief of Engineers, and I am particularly grateful to the members of that office — Karl C. Dod, Jesse Remington, Lenore Fine and Albert Cowdrey — for the

guidance they provided as professional historians within the Corps of Engineers. Invaluable support came from Professors Stuart W. Bruchey and William E. Leuchtenburg of Columbia University. Cory Heath Dude and Deborah Aschheim provided valuable research assistance at crucial points in this project. So did Le-Arie P. Chambers and Irma S. Cobb. The contracting officers at the North Atlantic Division, Colonels Joseph A. Lupi and Ralph E. Miles, and the Division's Historical Committee guided the project along to completion. Librarians Billy K. Tam and Penny Crumpler proved especially helpful. My special thanks to both Jared J. Miller, former Public Affairs Officer, and David J. Lipsky, Deputy Public Affairs Officer at the North Atlantic Division for the many hours they gave to this work. Finally, my gratitude to the following employees of the Reports and Communications Branch of the Baltimore District's Planning Division for their assistance in the final stages of this history's preparation: Mr. Henry Dunn, Branch Chief, who is responsible for the layout and coordination of the text and illustrations of this publication; Lynlee Brock and Donato Floriza, illustrators, for preparing the many illustrations found in the history; and, Glenda Himes, writer/editor, and Karen Cascio, editorial assistant, for editing the text and procuring the photographs for this history.

It is my hope that this history will be a valuable contribution to the understanding of the role that the North Atlantic Division and the U.S. Army Corps of Engineers played in the historical development of this country.

John Whiteclay Chambers II
Barnard College
Columbia University
New York, N.Y.

September 1977



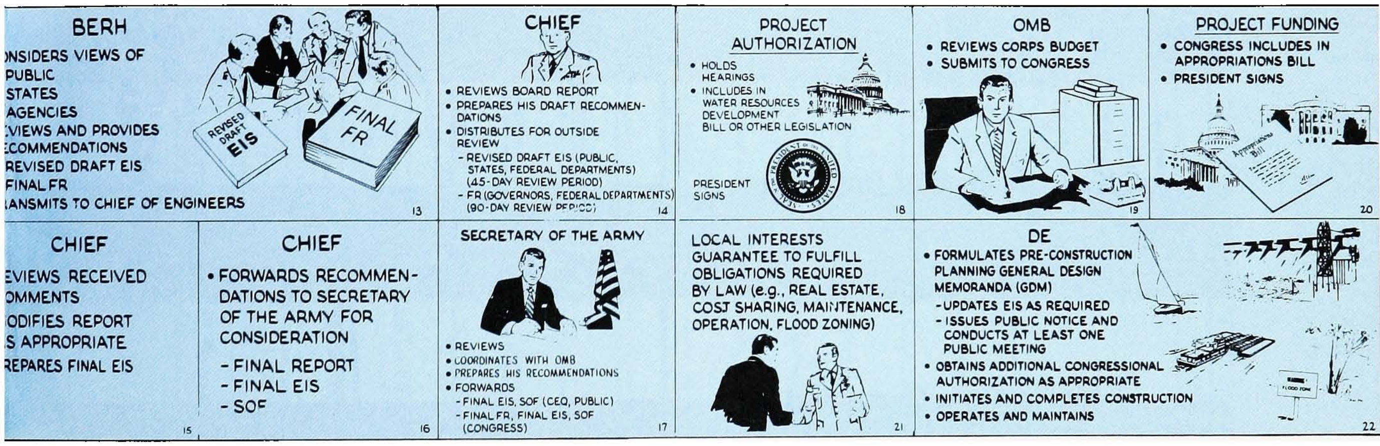
Steps in the Development of a Civil Works Project. To ensure full consideration of public needs, a lengthy process is required in any civil works project. Many steps of investigation, study, public hearings, recommendations, and consideration by numerous agencies are required. On the average, nearly 20 years elapse between the first study of a Corps of Engineers' civil works project and its completion.

INTRODUCTION

On June 16, 1975, the U.S. Army Corps of Engineers celebrated the 200th anniversary of its birth. Birthdays can be a time for assessments as well as celebrations. The marking of the Corps' first two centuries offered a fitting occasion for recounting and evaluating its development. This book provides a history of the Army Engineers in the northeastern United States during the period 1775-1975. It is the story of the North Atlantic Division (NAD) and the earlier organizations of the Corps in that region.

The U.S. Army Engineers originated on June 16, 1775, when General George Washington appointed Colonel Richard Gridley of Massachusetts to be the first Chief Engineer of the American Army. Gridley began his assignment by supervising construction of fortifications in support of the fledgling Revolutionary Army. Under the command of Colonel Gridley and his successors, the Engineers performed well in the Revolutionary War. Later, as the young republic matured, Congress recognized the need for a national engineering capability and in 1802 provided for a Corps of Engineers to be stationed at West Point. For nearly a quarter of a century, West Point remained the only engineering school in the country.

Over the years the Nation repeatedly called upon the Army Engineers to help solve major military construction and civil works problems. The Corps built the red brick forts along the coastline and assisted American Military combat forces. With the passage of the General Survey Act in 1824, Congress formally broadened the responsibilities of the Corps. It provided official recognition of the Corps' dual role of providing civil works support to the growing Nation in addition to providing combat engineering support for the Army. Throughout the 19th Century, the Corps proved instrumental in the expansion and development of the United States. Army Engineers helped explore, survey and map many regions of the country. For nearly 50 years, Army Engineers assisted in administering and preserving Yellowstone, Yosemite, and Sequoia Parks until the creation of the National Parks System. They constructed roads, railroads, bridges, and government buildings, and improved the navigability of waterways throughout the land.

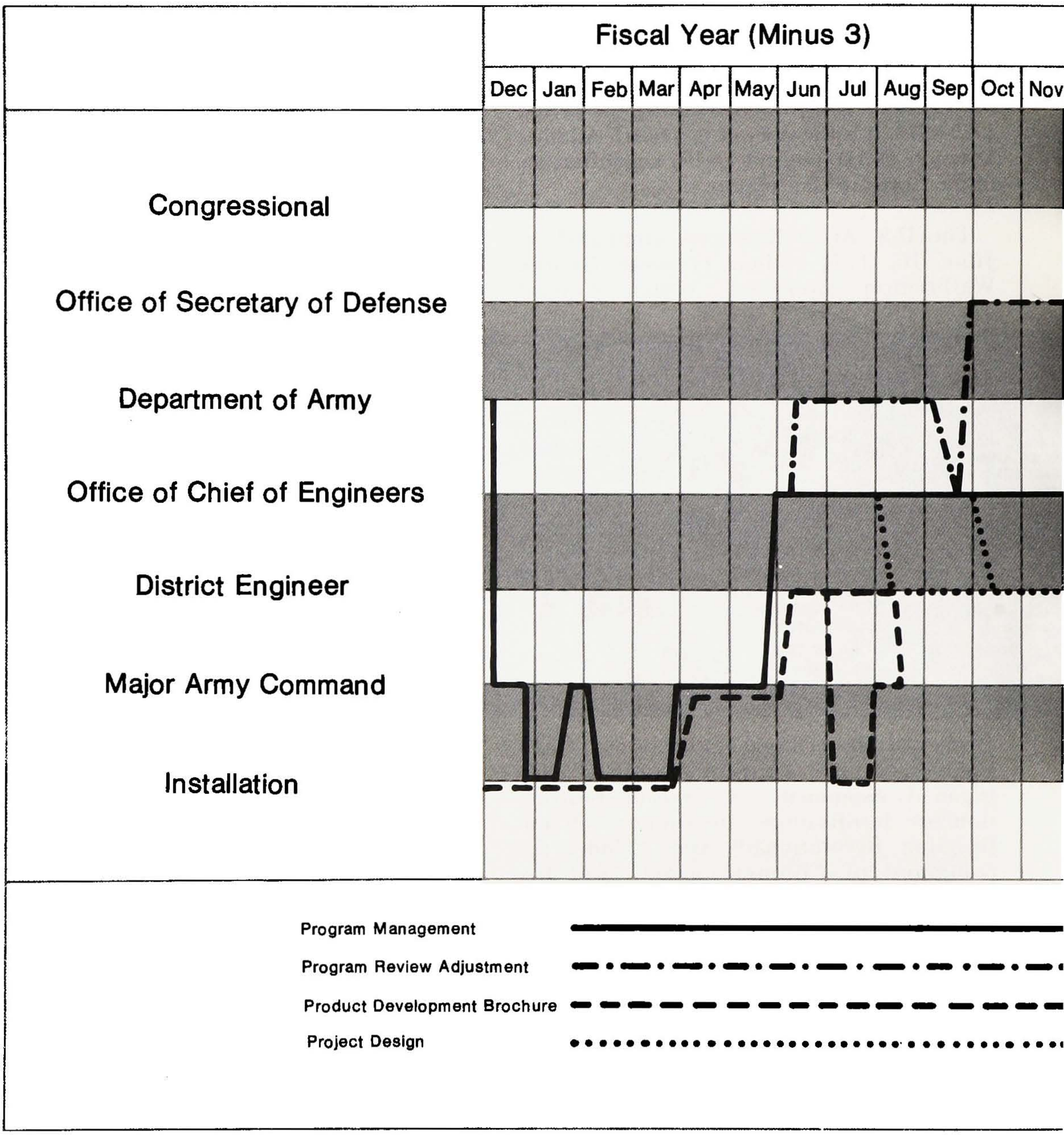


The 20th Century brought new and expanded responsibilities for the Corps of Engineers. Its members completed the construction of the Panama Canal and the modernization of many lesser waterways. In World War II, the Engineers received responsibility for military construction at home and abroad in the largest wartime mobilization of American history. In the Cold War that followed, they carried out military construction projects for the Army, the Air Force and the National Aeronautics and Space Administration. In civil works, a series of disastrous floods in the Northeast led Congress to enact legislation in 1936 which directed the Corps to undertake flood control on a

nationwide basis. This responsibility evolved to include hydroelectric production, water supply, fish and wildlife enhancement, recreation, and protection of the environment.

Today, from its headquarters in New York City, the North Atlantic Division supervises two sets of activities — military construction and civil works — in two overlapping regions. Its civil works area includes a half a dozen major river basins — the Hudson, Delaware, Susquehanna, Potomac, Rappahannock and the James. It covers the major ports of New York, Philadelphia, Baltimore and Norfolk. It

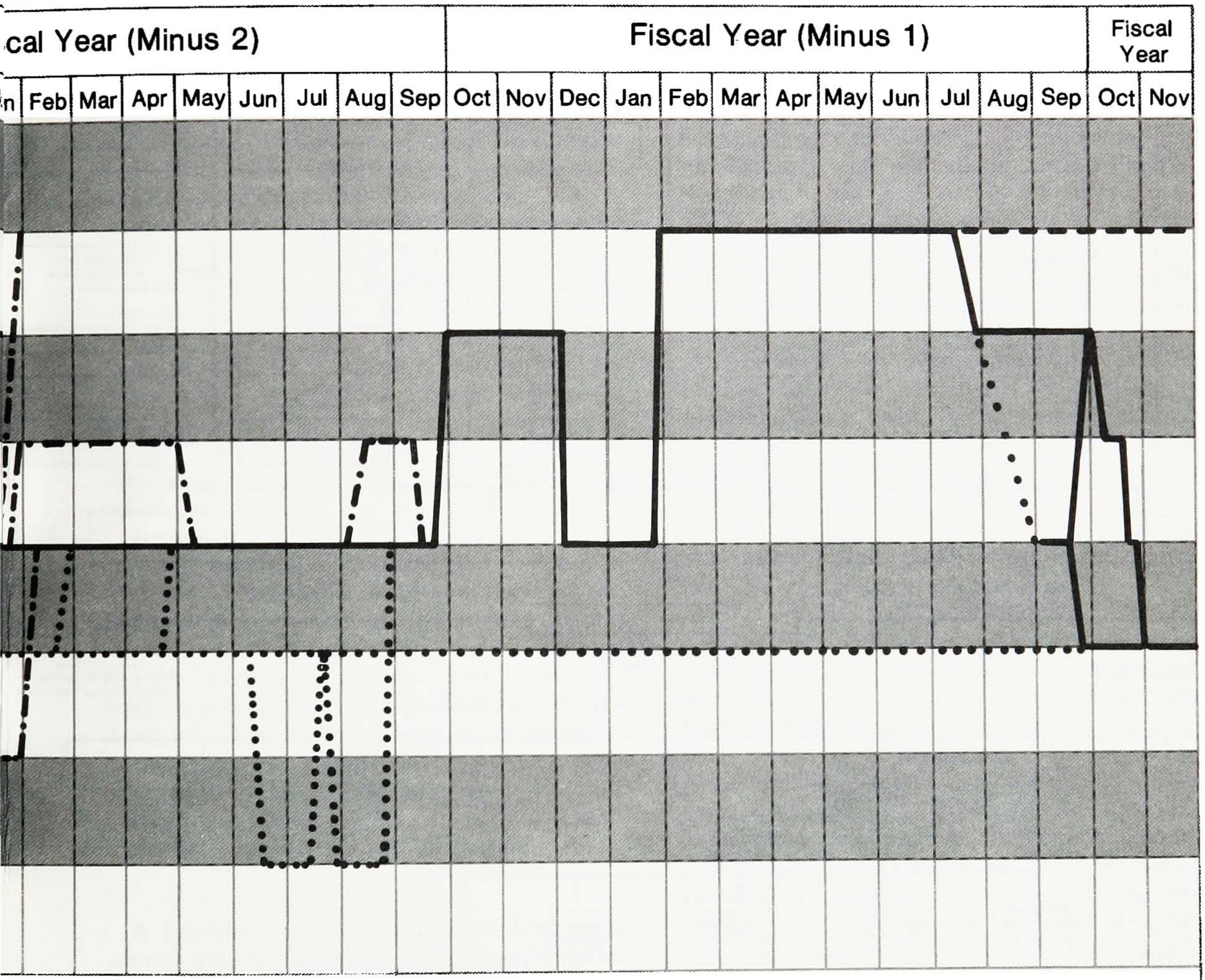
MILITARY CONSTRUCTION



encompasses the District of Columbia and all or parts of eleven middle Atlantic states from the Lake Champlain and the Hudson River Basins in Vermont and New York to the James River Basin in Virginia. Even larger is NAD's military construction area which includes the District of Columbia and 15 northeastern states from Ohio, Kentucky and Virginia north and east through New England, as well as offshore areas including Greenland, the Azores and Goose Bay Air Force Base, Labrador.

The heaviest concentration of urban, industrial, financial and communications

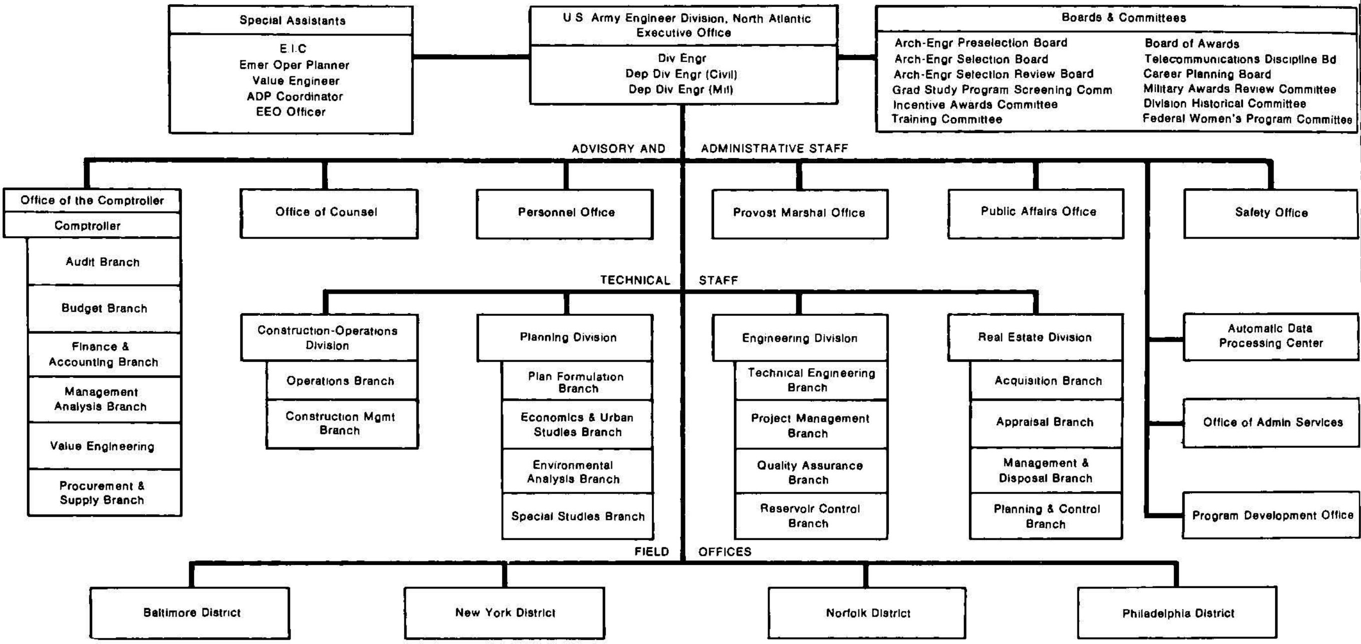
GRAM DEVELOPMENT FLOW CHART

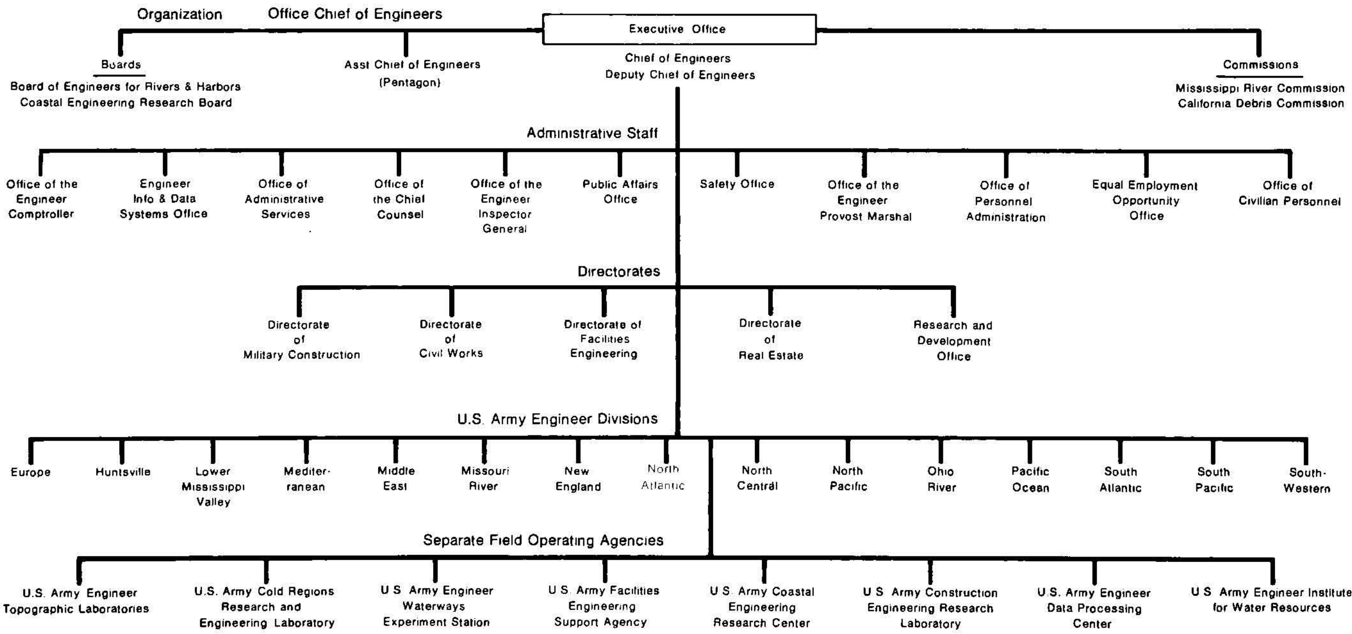


Military Construction Program Development Flow Chart. Because of the priority of military construction projects, they are completed in less time than civil works projects. The time flow chart illustrates how certain key steps must be taken within the three years before construction of the military facility begins. Twenty-seven different steps are required.

Top. North Atlantic Division Organization, 1977.

Bottom. Office of the Chief of Engineers Organization, 1977.





activities in the Nation are located in the region covered by the North Atlantic Division. Although the civil works area incorporated only 3 per cent of the land area of the United States, according to the 1970 Census, it had 20 per cent of the Nation's population. An estimated 82 per cent of the country's city-dwellers lived along the Atlantic corridor. An area of significant economic activity, it included nearly one-fourth of the manufacturing jobs and one-fourth of the personal income in the United States. In many ways, the North Atlantic Region remained the hub of the Nation.

The Corps of Engineers is the world's largest and most unique engineering organization. The Office of the Chief of Engineers (OCE) is located in Washington, D.C. The Corps of Engineers includes nearly 35,000 men and women assigned to Engineer troop units throughout the world. They provide combat engineering and construction support to the Army in the field. The annual budget for that military role is approximately $8 billion. In addition, a staff of 430 military officers and 29,000 civilians execute the civil works program with an annual budget of approximately $2.6 billion.

As its principal responsibility, the Office of the Chief of Engineers decides on the doctrine, organization, equipment, and employment of the Army Engineers and supervision of engineering operations. The Chief of Engineers also advises the Secretary of the Army on all engineering matters. In addition, he oversees a highly decentralized field organization, structured into Divisions and subordinate Districts. In 1975, the Corps included 14 Divisions and 39 Districts.

A Division is a middle-level management agency which supervises a number of Districts in its region. It functions between the Office of the Chief of Engineers in Washington, D.C. and the Engineer Districts on the local level. Except in certain special instances, the Division limits itself to supervision, review, coordination and liaison. It reviews design and construction progress performed by its Districts, inspects projects, and seeks to achieve maximum efficiency in cost and time. In keeping with the Corps of Engineers' emphasis on decentralization, it also seeks to maintain the authority of the local Districts.

As the primary local agency of the Corps, the Engineer District serves as the organization's main operating agency. The District Engineer has authority to execute most contracts involving the District. The District also interacts with the public. It holds responsibility for initial surveys and recommendations on proposed projects. It solicits bids for authorized projects and awards the contracts. It supervises most projects and occasionally does the work itself. The North Atlantic Division has Engineer District offices located in New York, Philadelphia, Baltimore and Norfolk.

The process by which the Corps of Engineers becomes involved in planning and constructing civil works projects is a lengthy one. On the average, nearly 15 years elapse between the first study of a project and the beginning of construction. This long process ensures full consideration of public needs. The process begins with the recognition of local or regional problems. Individuals or groups ask their Congressional representatives to authorize the Engineers' assistance in solving the problem. Only after Congress authorizes a study can the Corps become involved. After numerous studies, hearings, and evaluations, the project is either adopted, modified or rejected. If approved, construction is carried out under Corps' supervision. Funds come from public works appropriations.

Military construction projects involve a different and less time-consuming procedure. With the Army, the Air Force, or another Federal Agency as the client, fewer constituencies need to be consulted. Because of the priority of defense work, the time frame can be greatly compressed. Nevertheless, some 27 steps and actions must be accomplished in the three years before the fiscal year in which construction begins. Thus the planning and deliberation process for military projects consumes about one-fifth of the time for civil works projects. Funds come from the Defense Department budget.

The Corps of Engineers has built an effective organization to perform its civil works and military construction roles. In general, each level of command has both operating and administrative departments. The operating functions include engineering, construction, planning, programming and real estate management. The support functions in the administrative departments include offices of

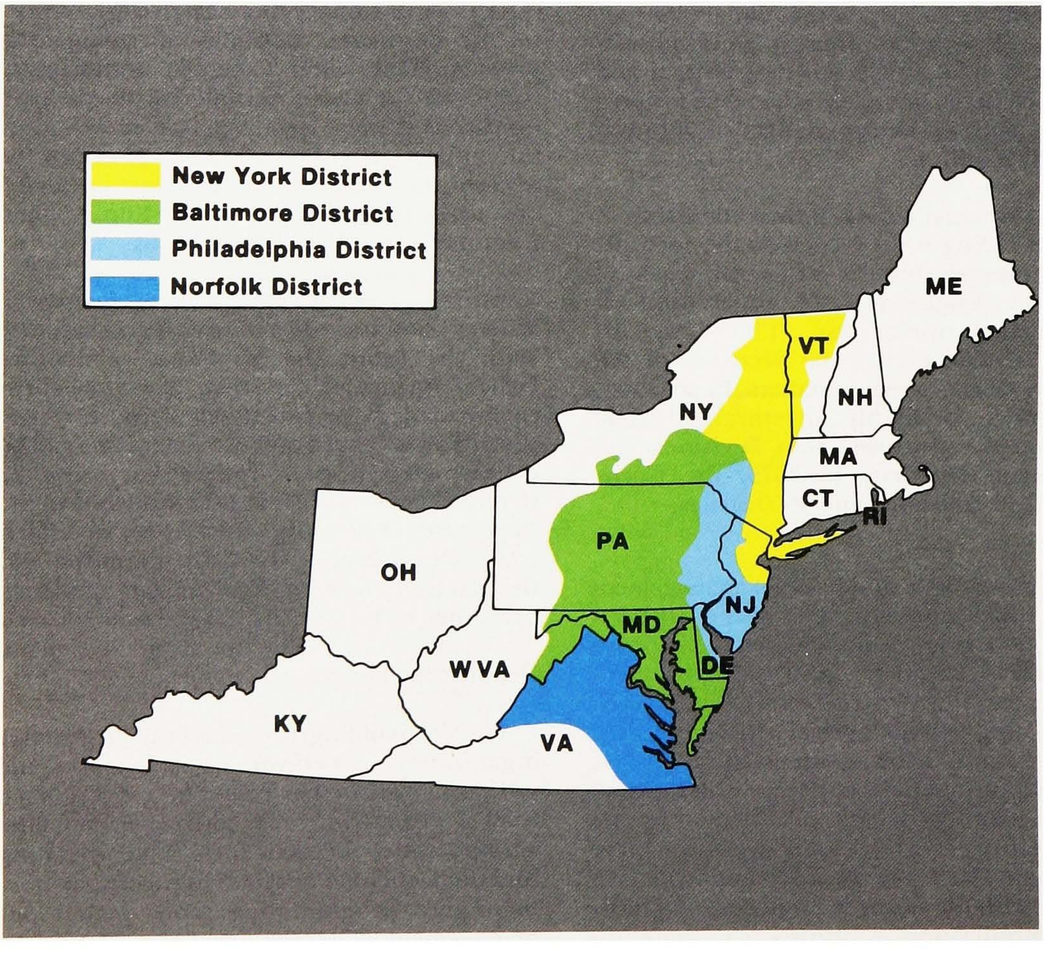
the comptroller, legal counsel, personnel, public affairs, the provost marshal, and safety. In addition, because of their construction-operations capabilities, the District offices have procurement divisions to obtain supplies. Sometimes, they also have special sections because of special missions. The Baltimore District, for example, has an office responsible for the operation and maintenance of the aqueduct supplying water to Washington, D.C.

In 1975, the North Atlantic Division had a staff of some 250 persons at its headquarters in New York City. They supervised the work of more than 4,000 persons in the four Districts. Although the great majority of NAD personnel were civilians, the top leadership were military officers. These included the Division Engineer, the Deputy and Assistant Division Engineers, and the Provost Marshal. The civilians in NAD were Federal civil servants who generally serve for long periods, thereby providing a continuity of work force. The professional soldiers are generally assigned for three-year tours of duty. The regular turnover of military leadership at NAD ensures fresh initiatives and different perspectives by the new officers.

During the mid-1970's, the annual budget of the North Atlantic Division ranged between approximately $400 and $455 million. Most of this was for construction projects. Only $4 million a year went for salaries and other costs at the Division headquarters. In Fiscal Year 1976, the Division and its four Districts obligated some $230 million on Army and Air Force construction and approximately $190 million on civil works activities.

The Division had a number of major civil works underway in the 1970's. Corps' dredges maintained channel depths in the ports. In

Territorial Jurisdiction of North Atlantic Division Civil and Military Boundaries within District Headquarters.



New York harbor, a new drift-collecting vessel, the *Haywood* joined the Corps' floating plant in collecting and removing debris which threatened shipping and pleasure boating. Combating serious erosion problems, dredges pumped sand ashore along the beaches of Long Island, the New Jersey shore, and Virginia Beach. Construction began in 1974 on the multipurpose Blue Marsh Lake on a tributary of the Schuylkill River near Reading, Pennsylvania. The dam and lake would provide facilities for flood control, water supply, and recreation. Other projects underway included Bloomington Lake on the Potomac River near Cumberland, Maryland, and Tioga-Hammond and Cowanesque Lakes on branches of the Susquehanna River in north central Pennsylvania.

In all Districts, the Engineers were directed to protect the environment while maintaining efficient use of the country's natural resources. Under the National Environmental Policy Act, the Army Engineers wrote environmental impact statements on their own projects as well as any proposed activity which might affect the navigable waterways. Through a permit system, they regulated the dumping of fill or other materials and the erection of structures in navigable waters.

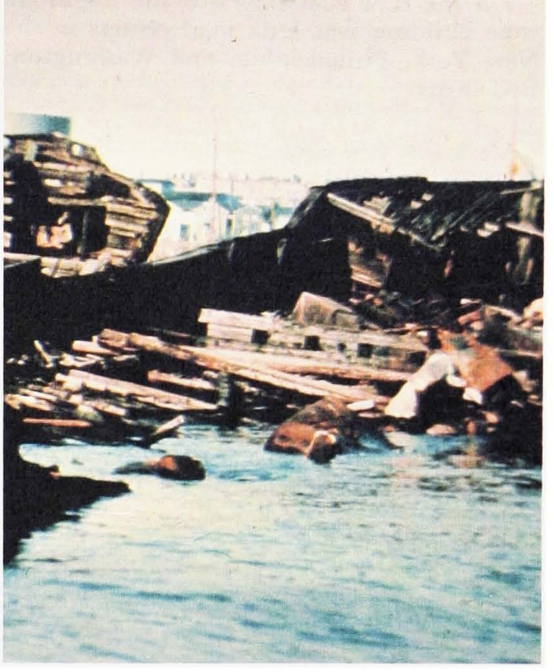
NAD also became involved in several regional planning studies. These included the North Atlantic Regional Water Resources Study, the National Shoreline Study, the Atlantic Coast Deep Water Port Facilities Study, and the Northeastern United States Water Supply Study.

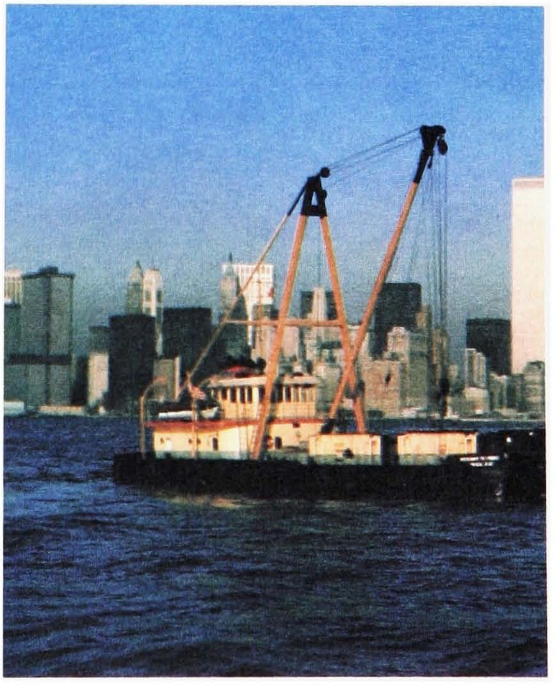
Two major military construction projects dominated the 1970s. The Division supervised the $110 million expansion and modernization of the United States Military Academy at West Point and the $140 million expansion of the Walter Reed Army Medical Center in Washington, D.C.

A number of smaller military construction projects were underway: Family housing at the Natick Laboratories, an Army Material Command facility in Massachusetts and a new library at Fort Monmouth, New Jersey. Dental clinics, commissaries, bachelor officers' quarters and enlisted men's quarters were under construction at several posts. The new Harry Diamond Laboratories Complex, one of the most modern weapons facilities in the

Top. Derelict Vessel in the New York Harbor.

Bottom. Collecting Drift in New York Harbor. To keep floating wood from jamming propellers and causing other damage to boating and shipping, Corps' drift-collecting vessels like the Driftmaster *scoop flotsam from the waters of busy New York Harbor.*





world, was nearing completion near Washington, D.C. An automated plant was under construction at the Radford Army Ammunition Plant near Blacksburg, Virginia. Pollution abatement devices were being installed at a number of Army bases, and a variety of training centers and other facilities were erected for the U.S. Army Reserve.

For the U.S. Postal Service, the Engineers were building new bulk mail centers in the New York, Philadelphia, and Washington, D.C. areas.

Over the past 200 years the relationship between the Corps of Engineers and the North Atlantic Region has been mutually beneficial. NAD and its predecessors provided fortifications and other defenses for the major coastal cities. The Army Engineers also responded to the region's needs for economic growth and an improved standard of living. Through river and harbor activities, the Engineers contributed to the development and operation of the major ports in the area. More recently, through flood control and pollution abatement, the Corps has assisted in improving living conditions. By helping to ensure water supply, and by making recreational areas available, NAD aided in meeting the needs of the region's growing population.

Similarly, the Corps of Engineers and the North Atlantic Division have benefited by serving the needs of the region. The existence of an experienced organization-in-being has allowed the Engineers to support the rapid mobilization of the Armed Forces in time of war or national emergency. The civil works program has aided the military by training Engineer officers in large-scale construction and related logistics efforts similar to those encountered in modern war.

The 200th birthday of the Corps of Engineers in 1975 signified a long and successful period of service by the Army Engineers in the North Atlantic Region.

CHAPTER 1

Early Years of the Army Engineers in the Northeast, 1775-1888

I
Introduction

The roots of the North Atlantic Division extend deeply into the history of the United States. From the founding of the young republic to its maturing as a Nation and its emergence as a world power, the missions of the Army Engineers have coincided with the development of the country. Both civil works and military engineering have responded to the needs and reflected the advances of the society.

During the first century of America's independence, the Corps of Engineers acquired many of its traditions. Among them was the important role the Engineers would play in the North Atlantic region. Gradually, the Engineers established their independence from the British and French engineering heritage. The U.S. Military Academy at West Point became the Nation's first engineering school. The Engineers performed valuable tasks in the American Revolution, the War of 1812, the Mexican American and Civil Wars. To defend America's major ports, they built one of the most impressive systems of coastal fortifications in the world.

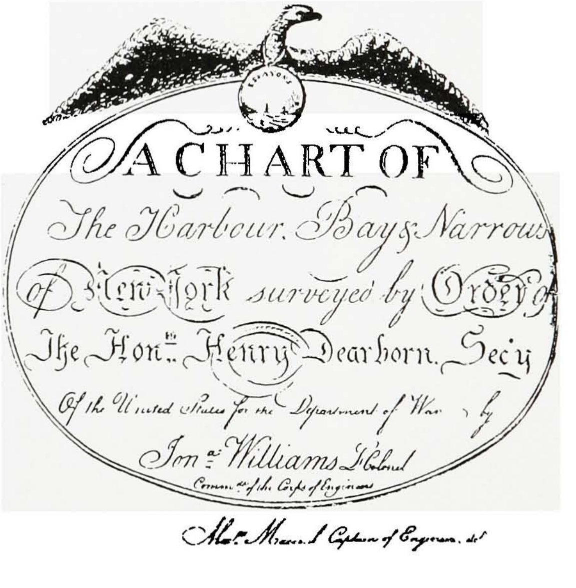
Army Engineers also carried out significant civil works missions which aided the economic growth of the region. Beginning in the 1790's, they constructed lighthouses and other aids to navigation and an Army Engineer laid out the new Capital City — Washington. With the coming of the transportation revolution in the early 19th century, the Army Engineers provided technical assistance and leadership for the construction of roads, canals and railroads under Congressional mandate. In the mid-19th Century, as the Nation's commerce expanded, they improved the navigability of the major rivers and harbors of the North Atlantic Region.

In the first century of the Nation's history, the Army Engineers created a tradition of service to both the military and civil works needs of American society.

Emblems of the Corps of Engineers. During the 19th Century, the distinctive emblems of the Corps of Engineers evolved. The button, which is still worn by officers of the Corps of Engineers, was designed by Engineer Officer Jonathan Williams or Alexander Macomb. The precise origin is still in dispute. However, the elements of the button — a fortress, a rising sun, an eagle, and a banner inscribed Essayons (Let Us Try) — first appeared together as illustrations for a map of New York Harbor which Macomb drew in 1807 as part of a survey for the Corps of Engineers. The button was adopted by Engineer officers on their new uniforms during the War of 1812.

Top. Engineer Uniform insignia: Essayons Button. Soldier Collar Ornament. Officer Castle.

Bottom. Legend and Signature from Macomb Map of 1807.



Early Corps of Engineers Uniforms. Engineer Corps Private, 1805. Engineer Officer, 1863

II
The Colonial and Revolutionary War Heritage to 1783

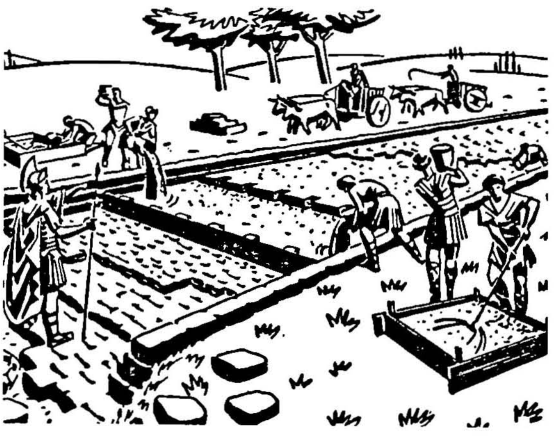
The American Army Engineers inherited a tradition of dual service. Although it dates back to the beginning of organized warfare, military engineering has almost always had some application to the peacetime pursuits of a society. The root of the English word "engineer" stems from the Latin term *ingenerare,* meaning "to create." Creating things has been one of the engineers' major roles. While Roman Legionnaires carried the art of building engines of war to new heights of development, they also constructed the roads, bridges, harbor facilities and other aids to navigation which facilitated the spread of commerce and communication throughout the Roman Empire. Engineers in other societies — Babylonian, Chinese, African and feudal European — also performed civil and military functions.[1]

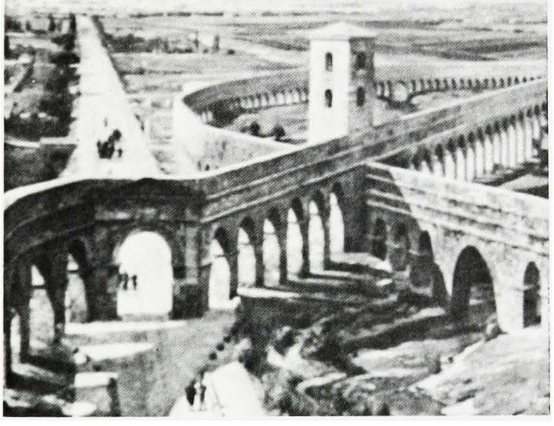
The British and French had continued this dual heritage and the Americans learned from them. Led by Sebastien le Prestre de Vauban, French military engineers established their leadership in fortification and siegecraft in the 17th century. They later established the Ecole Polytechnique, a special academy to train civil and military engineers. One of its graduates, Gustave Eiffel, built bridges and viaducts throughout the French Empire and became world famous when he constructed for the 1889 Paris Exposition a 1,000-foot iron tower, hailed as one of the greatest engineering feats in the world.

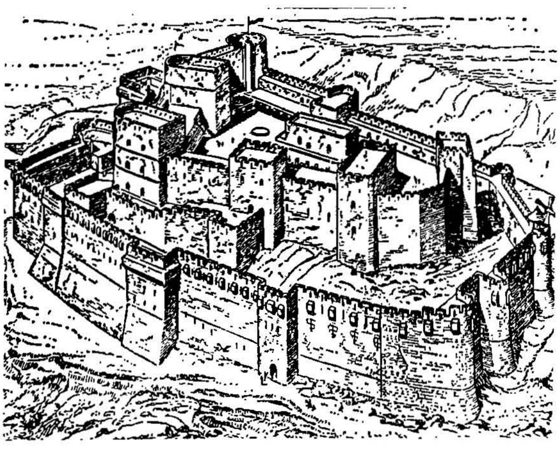
British Army engineers built lighthouses, harbor works, public buildings, utilities, roads, bridges and railways throughout the British Empire as well as aiding the British Army in its military operations. They received special prominence after their construction of the 1851 Exposition in London's Hyde Park. One of the highlights was the glass and iron Crystal Palace in which the weight of the building was carried by the steel framework rather than the walls, the principle behind the modern skyscraper.[2]

Until the establishment of the United States as an independent republic, American military engineering had been, like the colonies themselves, shaped by British

traditions and institutions. It was especially dependent upon England for its expertise. The American Revolution led the former colonists to seek French assistance and to try to take their destinies into their own hands. They sought to establish their own institutions as viable and legitimate. The change, however, did not always come quickly. It took nearly 50 years after the Declaration of Independence to end the predominance of European military engineers in the United States.







In the meantime, American Army Engineers, drawing upon foreign advisers, provided much military assistance for the successful waging of the American Revolutionary War. Significantly, the first Chief Engineer of the U.S. Army had learned his profession and achieved initial prominence while serving with the British Army in colonial America. Richard Gridley of Massachusetts was a retired colonel and engineer-artillerist when he became chief engineer of the American Army. He assumed command in 1775 when the American troops surrounded the British Forces in Boston. Under his direction, engineers established the American fieldworks on Breed's and Bunker Hills and on Dorchester and the other heights around the city. Although the Americans were driven from the first two positions, their superiority in the other positions forced the British to flee.[3]

During the American Revolution, the Army Engineers continued to provide major support for the military effort on behalf of independence. They received advice and leadership from sympathetic European officers. After the alliance with France, several French engineers arrived. Their senior member, General Louis le Bègue du Portail, was appointed Chief Engineer of the American Army in 1777. The American Engineers also received the assistance of a Polish engineer, Thaddeus Kosciuszko. With such help, the engineers laid out fortifications at Fort Washington in Manhattan and Fort Lee in New Jersey. In addition, they strung an iron chain across the Hudson River to impede the British fleet. Furthermore, they expanded the fortifications on the West Point highlands to make it an "American Gibraltar." By the end of 1779, West Point was considered the

Top. Road Construction by Roman Engineers.

Source: John Anderson Miller, Master Buildings of Sixty Centuries *(Freeport, New York, Books for Libraries Press, 1938).*

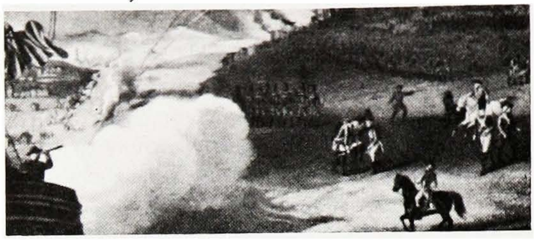
Center. Intersection of two ancient Roman Aqueducts near Rome.

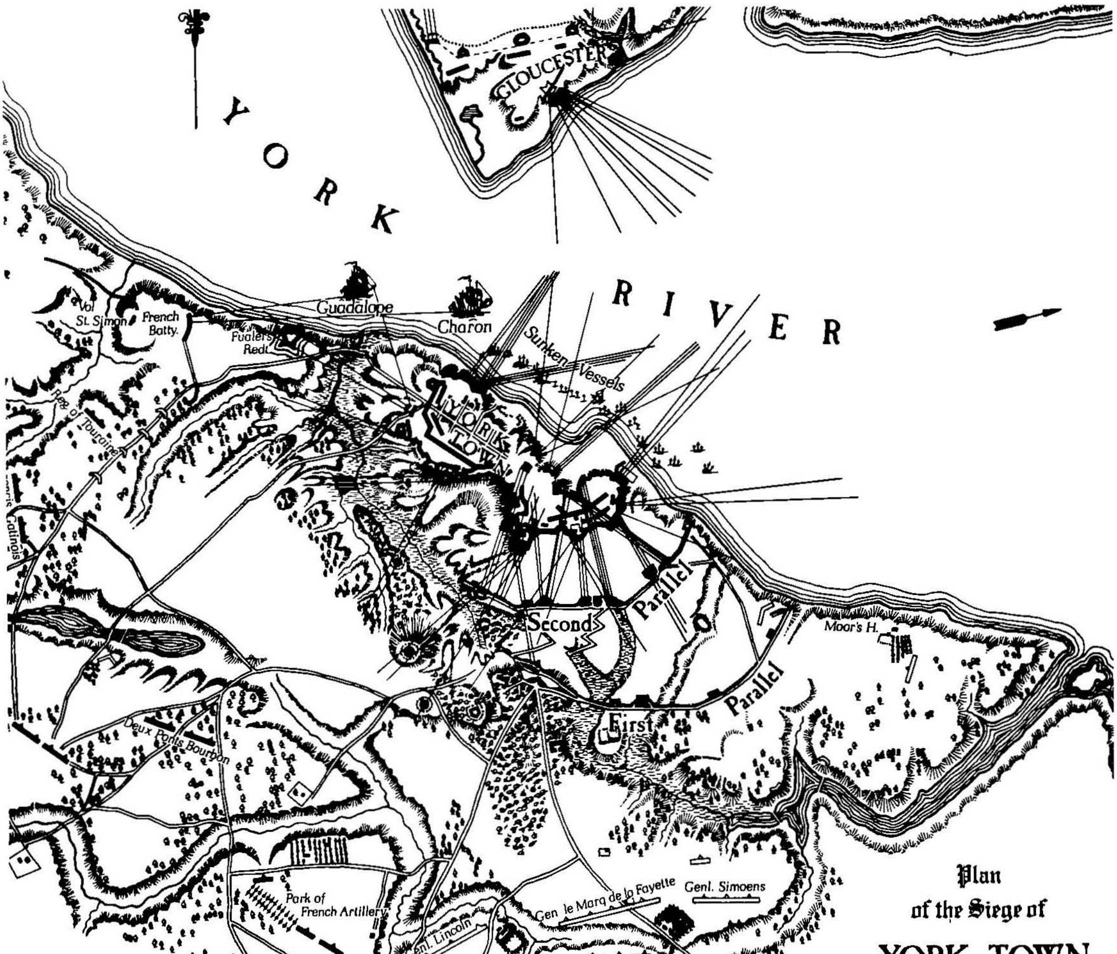
Bottom. Krak des Chevaliers, built by the Crusaders during the 13th Century on a mountain in Syria, was the strongest Fortress in the World.

Source: "Figure 23" from The Ancient Engineers *by L. Sprague de Camp. Copyright 1963 by L. Sprague de Camp. Reprinted by permission of Doubleday and Company, Inc.*

strongest military post in America. Large quantities of gunpowder, provisions, and munitions were stored there. Companies of American Engineers built fortifications at Dobbs Ferry, New York, threw bridges over the Schuylkill and other rivers, and prepared the encampment and defense at Washington's winter headquarters at Valley Forge, Pennsylvania.

The Battle of Bunker Hill.

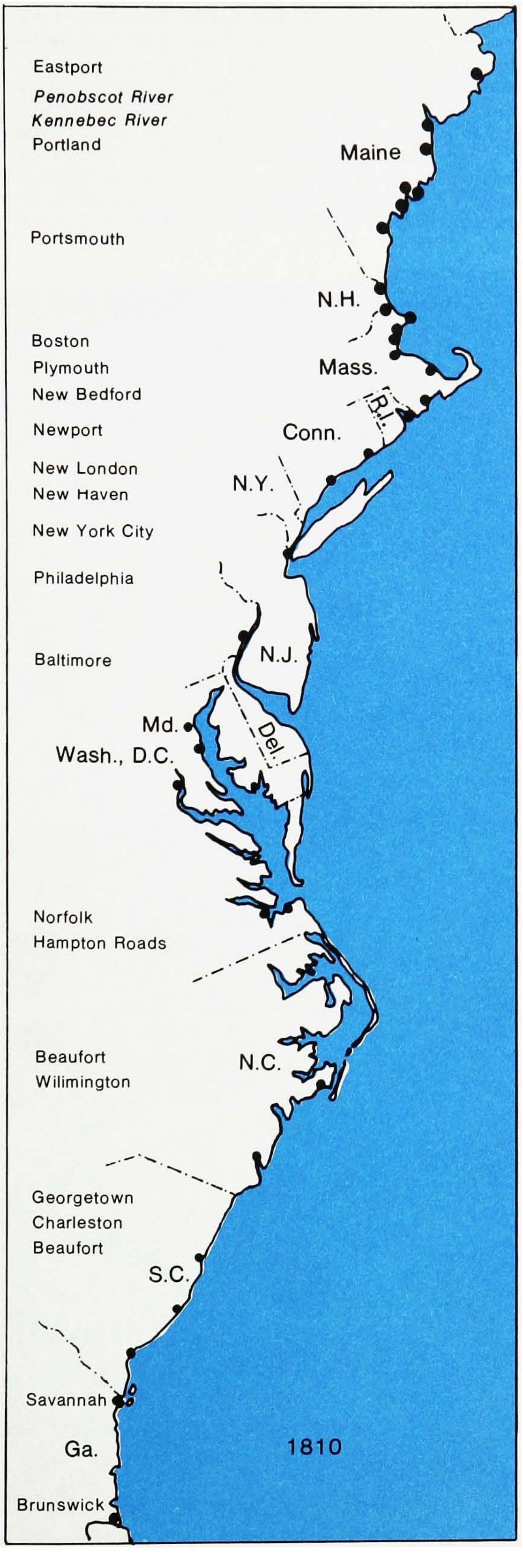


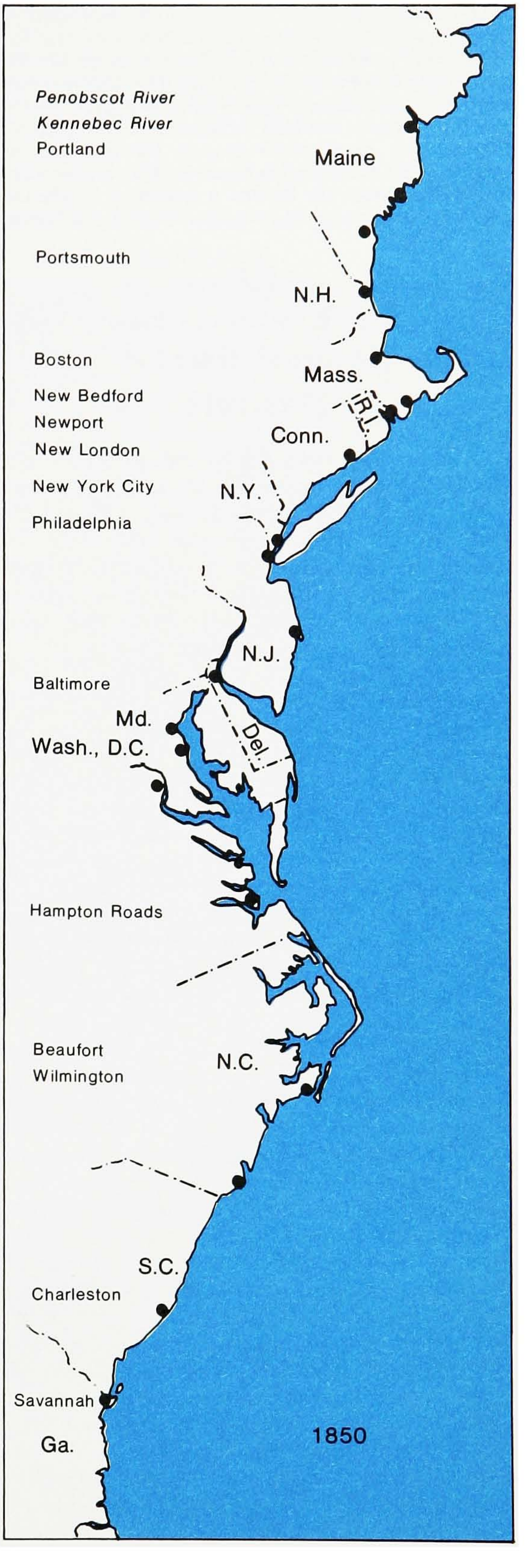


Map prepared by British Officers in 1781.

In the siege of the British positions at Yorktown, Virginia, in 1781, the Army Engineers achieved one of their most significant accomplishments of the war. First they constructed the American fortifications. Then they attacked the British emplacements, advancing a series of parallel trenches toward the British lines under the cover of an Allied artillery barrage. When an assault led by the engineers captured two redoubts and a British counterattack was beaten back, the British commander surrendered. The Americans had won their independence. Following the signing of the peace treaty, most of the U.S. Army, including the engineers, was disbanded.[4]

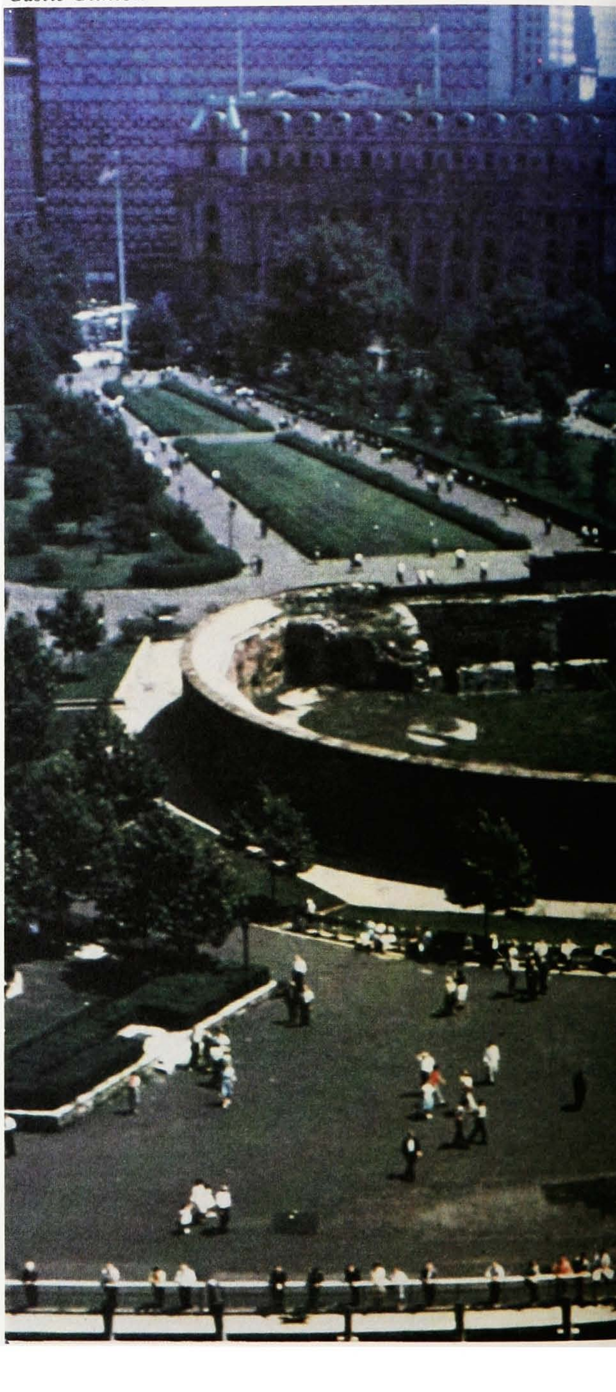
Seacoast Fortification Localities, 1810 and 1850.





New York Old and New. Dwarfed by the skyscrapers of lower Manhattan in 1961, Castle Clinton remains a symbol of the early fortification system designed to protect the seaport city in the early 19th Century. The little structure has had a varied career. Planned as a companion defense structure to Castle Williams on Governor's Island, Castle Clinton was never raised beyond the first tier of emplacements. Construction began in 1808 on some rocks just offshore from the Battery, a section of Manhattan which had been the site of a fort since the town was known as New Amsterdam. It was named after New York's governor DeWitt Clinton. The War Department transferred it to the City of New York in 1823 and for more than 30 years it served as an entertainment center known as Castle Gardens. In 1855, it became an immigration reception center, the point of arrival for thousands of Irish, Germans, and others who came to the United States in the mid-19th Century. When a more modern immigration center opened at Ellis Island in the 1880s, the old fortress was converted into the New York City Aquarium, serving

Castle Clinton



III
The Engineers and National Defense
1794-1814

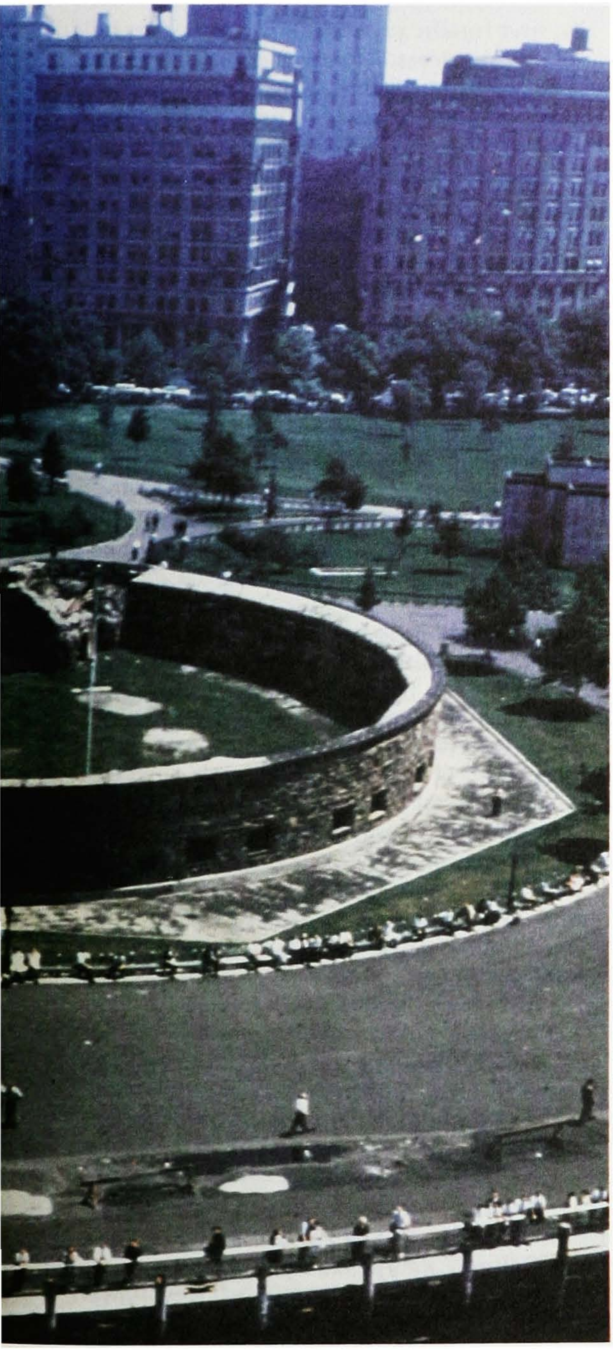
After a brief tranquil period, international affairs became unsettled in the 1790s and 1800s due to the French Revolution and the Napoleonic Wars. This led the U.S. to reconsider its military establishment and coastal defenses. The result was an expansion of the size and the role of the Army Engineers in the North Atlantic Region.

In a series of decisions beginning in 1794, Congress authorized the construction of a string of coastal fortifications to protect key harbors against raiding expeditions. To design, build and operate the new battlements, on May 9, 1794, the legislators created a Corps of Artillerists and Engineers. Among the men who directed the work were two French-trained engineer officers, Pierre Charles l'Enfant who later designed the new Federal City at Washington, and Stephen Rochefontaine, who later commanded the Corps.

On March 16, 1802, President Jefferson obtained authority from Congress to establish a permanent military academy at West Point. The lawmakers also established a Corps of Engineers which would be stationed there and a Chief Engineer who would be superintendent of the military academy. For half a century — from 1802 to 1866 —the Corps of Engineers maintained its supervision over the U.S. Military Academy. One of the main reasons for establishing the academy was, as the Secretary of War explained to a friend, so that "we may avoid the unpleasant necessity of employing foreigners as Engineers."[5] For many years, the Academy was the only engineering school in the United States. Not until 1835 did Rensselaer Polytechnic Institute graduate its first class of civil engineers.

in that capacity until after World War II. It is currently a National Monument.

For years, it guarded the inner entrance to the Port of New York, but Fort Wood is now most famous as the base for the Statute of Liberty. An eleven-pointed star fort without bastions, it is one of the truest examples of star-fort architecture in the country. Constructed of masonry-faced earthworks before the War of 1812, Fort Wood was repaired and slightly modified in the 1840s. It was named after Brevet Lt. Col. Eleazer D. Wood who was killed in action in 1814 at Fort Erie, Canada. In the 1880s, the fort was deactivated and made the base of the statue being constructed as a symbol of American liberty. The island was renamed Liberty Island instead of Bedloe's Island.
Source: National Park Service



Ft. Wood and Statue of Liberty.

Harvard, Yale and the University of Michigan followed in the 1840s. Even up to the 1850s, however, nearly all of the engineers — military and civilian — had received their scientific education at West Point.[6]

The primary task of the Army Engineers was to build fortifications and to assist military commanders in wartime. The emphasis of the young republic upon coastal fortifications as a major part of its defense reflected certain deeply-rooted American beliefs. It also served as a harbinger of future policy. From the English Civil War of the 17th Century and from their own experience with Britain in the 18th Century, most Americans came to distrust strong central governments and large standing armies. In order to avoid reliance upon such extensive and permanent armed forces, they devised a unique defense system. It included a limited Navy, a small Regular Army, an expandable militia of citizen-soldiers and, beginning in 1794, extensive coastal fortifications. Stationary guns ashore were more accurate than the guns of swaying ships afloat, therefore, Americans hoped these forts would provide adequate security. They would do so without the necessity of a large standing army. In peacetime, the fortifications required only maintenance. They could stand virtually empty awaiting, like the militia, the call to arms when war broke out.

Fort McHenry, Baltimore, Maryland.

The harbor defense program begun in 1794 proved only the first in a series of fortification construction programs that continued intermittently for nearly a century and a half. Not until after World War II did the Nation abandon such a system. The emphasis upon fortifications illustrated the defensive focus of U.S. military and naval policy during the 19th and much of the 20th Centuries. It also reflected an American emphasis on technology as an alternative to the maintenance of substantial military forces. In the 150-year construction program, the Corps of Engineers played a major role.[7]

The first fortification system was begun by the Army Engineers between 1794 and 1795. It consisted of some 16 forts along the principal seaports of the Atlantic Coast. The then substantial sum of $76,000 (the entire Federal budget was only $7 million) was appropriated by Congress to purchase the sites and assist the States and municipalities in beginning construction. Built as emergency rather than permanent structures, these forts were primarily earthworks, sometimes faced with timber. Most were composed mainly of batteries of guns behind the earthen parapets. Some occasional redoubts or wooden blockhouses dotted the coastline; however, armament consisted of Revolutionary War cannons with some new cast iron, muzzle-loading 23- or 32-pounders. Infrequently, eight-inch howitzers or sixteen-inch mortars provided high trajectory weapons.

A second and more extensive fortification project emerged during the first decade of the 19th Century. It began in 1798 during the threat of war with France when American and French naval vessels were engaged in combat over seizures of American shipping. The earthworks of 1794 had deteriorated because of weather conditions and lack of maintenance, so in 1798, Congress appropriated an initial $250,000 for repair and rebuilding of the fortifications and the erection of some new defense works. Among the new works was the first use of masonry in American military architecture.

The Nation's second fortification-building program entered another phase after 1807 when the country faced the possibility of war with Britain. Conflicts caused by the seizure of American seamen and ships in the British blockade of Napoleon's empire escalated tensions. After H.M.S. *Leopard* attacked the U.S. Warship *Chesapeake,* Congress authorized an extensive fortification program. Beginning in 1807, it appropriated an initial

$1 million (10 percent of the Federal Budget), and ultimately more than $3 million over the next five years, to provide defenses at up to 50 locations along the coast. The fortifications constructed before the War of 1812 represented the first construction effort of great size planned and executed by engineers of American birth and training.

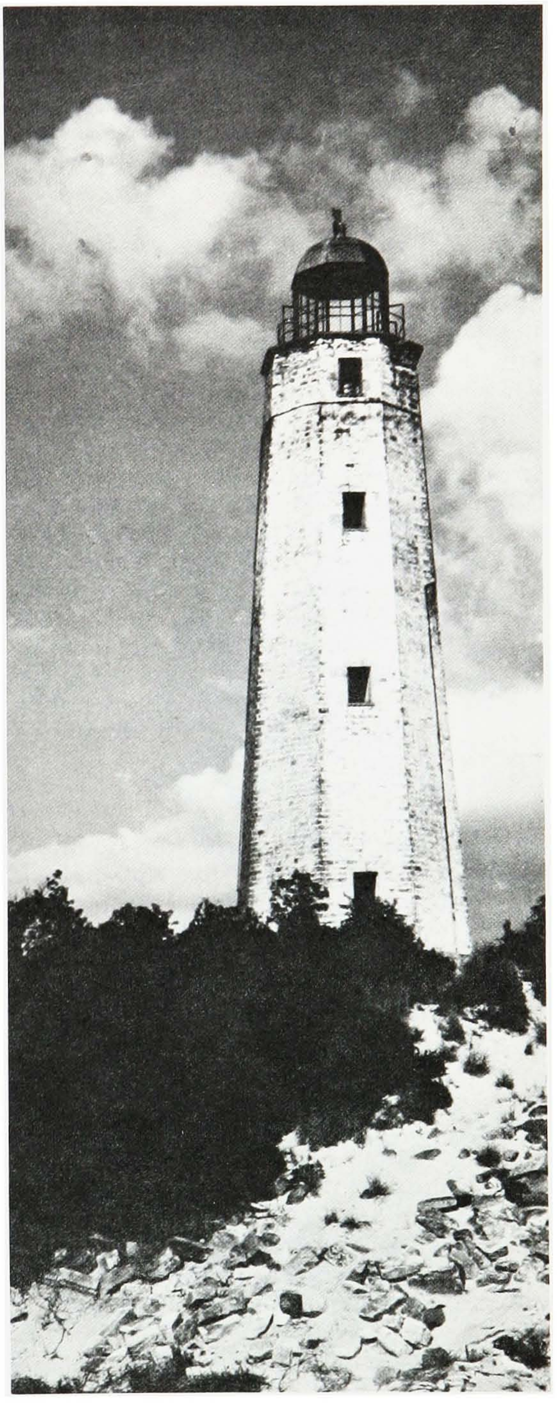
This fortification program included much more elaborate and permanent structures than the earlier earthwork. The Army Engineers supervised construction. They built masonry-faced earthworks and a few multi-tiered brick fortresses.

By the War of 1812, this building program had been substantially completed. In general, American seaports then had one or two fortifications of at least moderately respectable size and strength. Most of the guns of these forts and batteries were similar to those of the Revolution in design and operation, but their caliber had increased. They now included 42- and 50- pounders of American design known as "Columbiads," which fired not only solid shot but also explosive shells known as bombs. In 1812, the United States had 24 forts and 32 enclosed batteries with a total of 750 guns. Located all along the Atlantic Coast, these represented a formidable defense when the War of 1812 broke out.

Not one of the forts built by the Corps of Engineers fell to the enemy in battle during that war. A combined British naval and land force captured and burned Washington, D.C., but the fire from Fort McHenry turned back the invaders at the entrance to Baltimore Harbor. The strong defense inspired Francis Scott Key, an American poet held captive on a British ship, to write *The Star-Spangled Banner.* His poem celebrated the flag which continued to wave over the American fortress despite the two-day bombardment by the British fleet. The engineers also emerged from the land operations of the U.S. Army with a heightened reputation. A company of engineers served with distinction in upstate New York near the Canadian border. Several engineer officers received special commendations for their part in the defeat of a British invasion force at Plattsburgh, New York. The war experience confirmed the military value of the Corps of Engineers.[8]

The Cape Henry Light. The Cape Henry Lighthouse at the entrance to Chesapeake Bay was the first lighthouse built by the Federal Government. An octagonal sandstone tower, it was constructed in 1791. Although Cape Henry Lighthouse was replaced in 1881 by a new iron and masonry lighthouse, the old structure was maintained by the State of Virginia as a monument commemorating the landing of John Smith.

Photograph courtesy of the Virginia State Library.



IV
The Engineers and Civil Works 1790-1860

Even in the early years of the Republic, the Army Engineers demonstrated their value in civil as well as military pursuits. The dual use of the engineers had been part of the European tradition and had been advocated by John Adams' Secretary of War James McHenry in 1800. "Their utility extends to almost every department of war. .," he said, "besides embracing whatever respects public buildings, roads, bridges, canals, and all such works of a civil nature."[9]

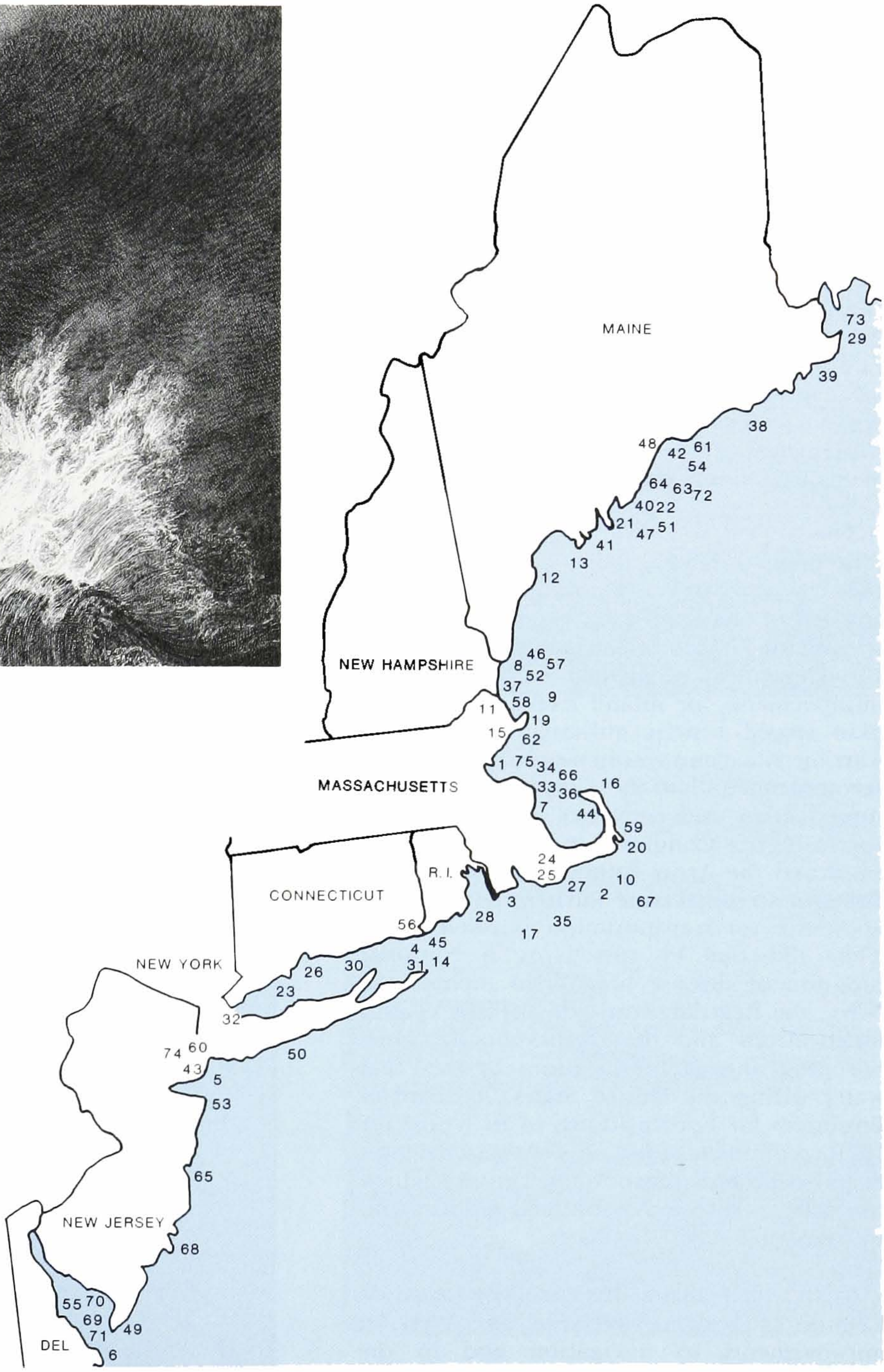
The first Federal public works began with aids to navigation. In the 1790's, the U.S. Government authorized the construction of a lighthouse at the entrance to the Chesapeake Bay, a navigational improvement which benefited a number of states. Although private contractors built the structure, the Federal Government soon began to employ Army Engineers in its public works programs. In 1802, Congress authorized the erection and maintenance of ice breaker piers at the entrance to the Delaware River. These were designed to enable ships to get through the winter ice to Philadelphia, then the Nation's busiest port. Construction of these ice piers off New Castle, Delaware, represented one of the first Federally-supported, non-military public works. Officers of the Corps of Engineers supervised the work.

In the first half of the 19th Century, Americans pushed over the Appalachian Mountains and surged across the land. A virtual revolution in transportation accompanied this migration. Improved roads and canals and new steamboats and railroads hastened travel and reduced the cost of shipping goods. The opening of the Erie Canal in 1825 initiated an unprecedented expansion of transportation. It linked New York City with the farm regions of the upper Midwest. The other major seaports — Boston, Philadelphia and Baltimore — also sought to expand their hinterlands. They constructed canals and later built railroads. Work began on the Nation's first major railroad — the Baltimore and Ohio Railroad — in 1828. By the time of the Civil War in 1861, the railroads carried as much freight as did waterborne commerce.[10]

1. Boston
2. Brant Point
3. Beavertail
4. New London
5. Sandy Hook
6. Cape Henlopen
7. Plymouth
8. Portsmouth
9. Cape Ann
10. Nantucket
11. Newburyport Harbor
12. Portland Head
13. Sequin Island
14. Montauk Point
15. Baker's Island
16. Cape Cod
17. Gay Head
18. Eaton's Neck
19. Annisquam Harbor
20. Chatham Harbor
21. Franklin Island
22. Whitehead Island
23. Black Rock Harbor
24. Clark's Point
25. Butler Flats
26. New Haven Harbor
27. Cape Poge
28. Point Judith
29. West Quoddy Head
30. Falkner's Island
31. Little Gull Island
32. Sands Point
33. Scituate
34. Long Island Head
35. Tarpaulin Cove
36. Race Point
37. Boon Island
38. Petit Manan Island
39. Libby Island
40. Owl's Head
41. Pemaquid Point
42. Dice Head
43. Fort Thompkins
44. Long Point
45. Windmill Point
46. Isle of Shoals
47. Monhegan Island
48. Moose Peak
49. Cape May
50. Fire Island
51. Matinicus Rock
52. Cape Elizabeth
53. Navesink

Below. Bell Rock Lighthouse. This drawing of the Bell Rock Lighthouse was designed to accompany Robert Stevenson's An Account of the Bell Rock Lighthouse.
Source: Library of Congress

Right. Lighthouses Along the North Atlantic Coast.



54. Baker Island
55. Brandywine Shoal
56. Morgan's Point
57. Whaleback
58. Ipswich
59. Nauset Beach
60. Robbins Reef
61. Bear Island
62. Marblehead
63. Mount Desert Rock
64. Saddleback Ledge
65. Barnegat
66. Minots Ledge
67. Sankaty Head
68. Absecon
69. Ship John Shoal
70. Cross Ledge
71. Fourteen Foot Bank
72. Bass Harbor Head
73. St. Croix River
74. Statue of Liberty
75. Derby Wharf

The financial support of the Federal Government for these internal improvements, as they were called, provoked major sectional and Constitutional debates in the antebellum years.

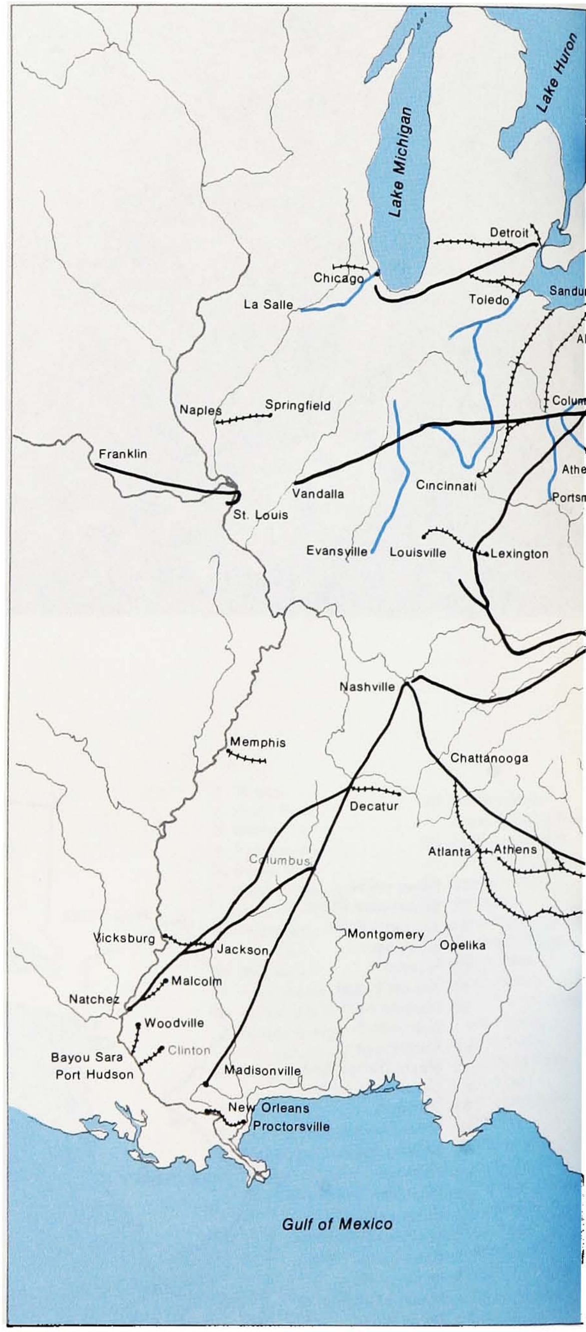
The South tended to oppose the development of new routes which would help the Northeast capture the Midwestern hinterland. Already enjoying an extensive system of navigable rivers and linked to the Midwest via the Mississippi River, the South opposed taxing its consumers through high tariffs to pay for improvements in competing regions. Southern Presidents took a strict constructionist view of the Constitution and vetoed many internal improvement bills. They considered them local in character and outside the delegated authority of the Federal Government. However, Congress and the Presidents began to authorize some internal improvements. In doing so, they were influenced by the East and the West, by an organic view of the Nation, and by arguments which stressed the value of internal improvements to national defense.

The appeal to national defense proved a convincing argument to many in Congress. In 1824, Secretary of War John C. Calhoun, then an ardent nationalist, proposed a broad scheme for Federal construction of both roads and canals, supplemented by navigational improvements for inland rivers. He said his plan would benefit military operations in wartime and commerce in peacetime. Calhoun recommended that the Corps of Engineers survey, plan and construct these projects.[11] Increasingly, Congress and the Executive employed the Army Engineers to bypass the domestic sectional issue and to provide Federal assistance for transportation improvements. They did this by conceiving a National program of defense broadly to include the Navy, the Regular Army, the Militia, coastal fortifications and the facilitation of transportation and communications by land and water within the United States. A Board of Engineers for Fortifications, in its report for 1821, recommended not only seacoast defenses but also inland transportation routes which could be used to move soldiers, supplies and equipment.[12]

In the early 1820s, therefore, the Corps of Engineers became actively involved in improvements to navigation and in the

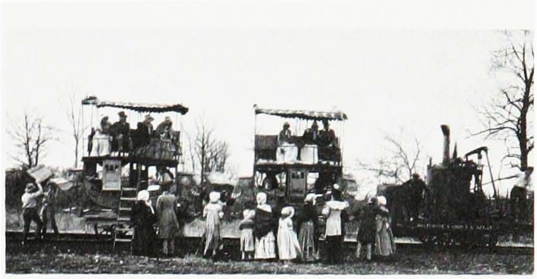
American Passageways.
Source: David Jacobs and Anthony Neville, Bridges, Canals and Tunnels, *(New York: American Heritage Publishing Company, 1968).*

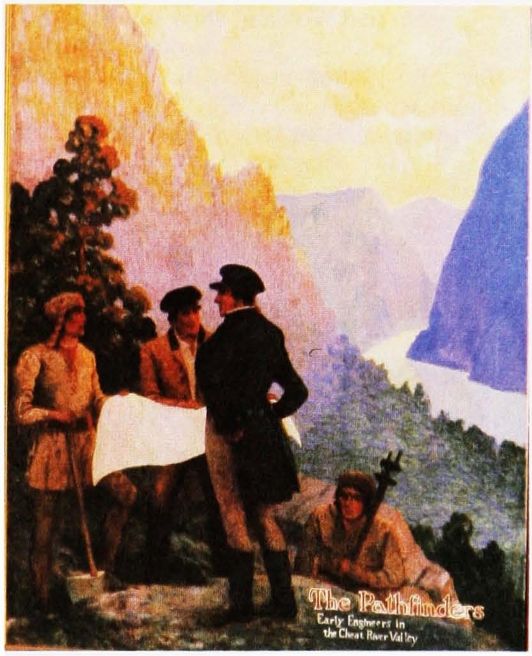
Top Right. The Atlantic *and Its Trial Run, 1832.*
Source: Archives of the Baltimore and Ohio Railroad Museum/Chessie System.

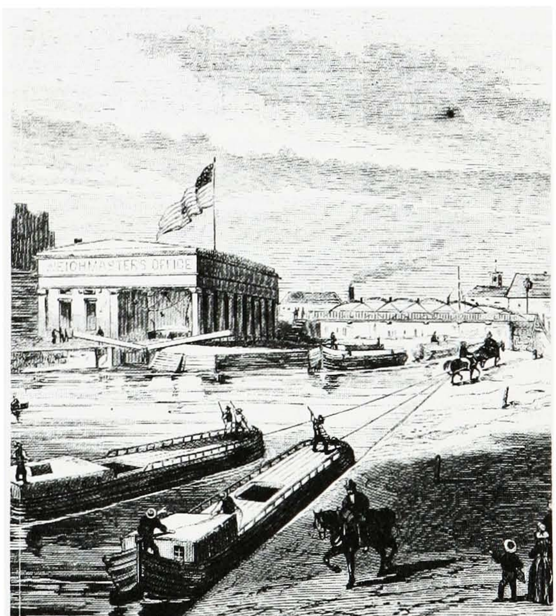


Center Right. Surveying for the Railroad, 1830.
Source: Archives of the Baltimore and Ohio Railroad Museum/Chessie System.

Bottom Right. The Erie Canal.
Source: David Jacobs and Anthony Neville, Bridges, Canals and Tunnels *(New York: American Heritage Publishing Company, 1968).*







construction of roads, canals and railroads. At the direction of Congress, the Corps of Engineers studied the feasibility of a breakwater at the mouth of the Delaware River. Their report recommended construction to protect vessels from tempests and floating ice which hampered the efficiency of the Port of Philadelphia. Army Engineers supervised construction of the breakwater. Under orders from President Monroe, Army Engineers surveyed and then supervised work on the National Road from Cumberland, Maryland, at the head of navigation on the Potomac, to Zanesville, Ohio. It helped to open new areas of settlement. Officers of the Corps made recommendations for the best route for a Chesapeake and Delaware Canal which would reduce the coastal route from New York and Philadelphia to Baltimore, Washington and Richmond. In addition, they assisted civilian engineers in the difficult tasks of constructing the many locks and inclined planes in the Morris Canal between Phillipsburg on the Delaware River and Jersey City on the Hudson River.

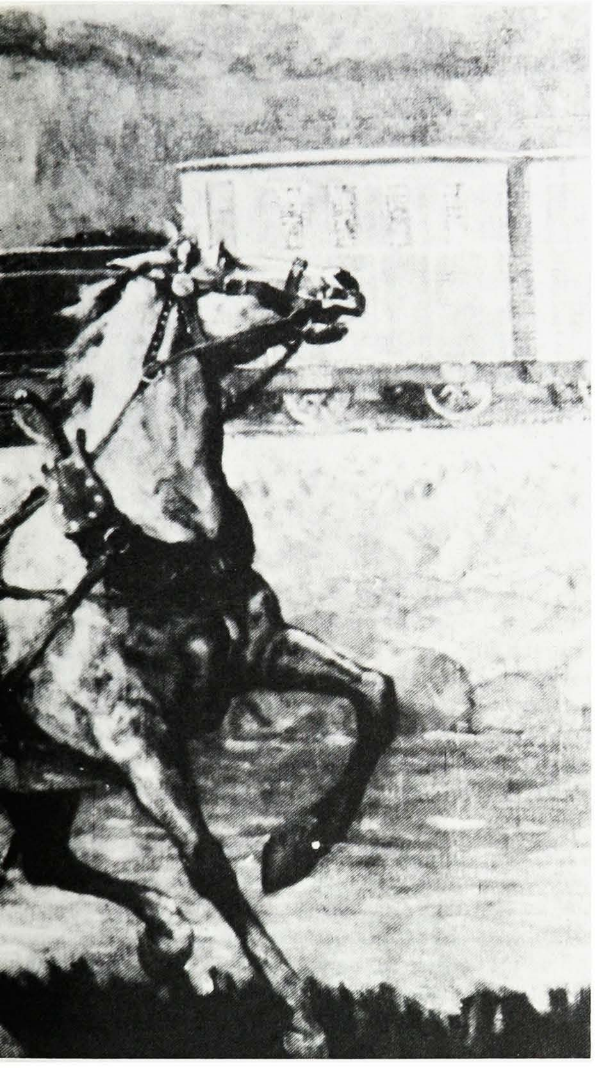
The expanded role of the Army Engineers in civil works — particularly involving the Nation's transportation network — received official recognition and further impetus in the General Survey Act of 1824.[13] This legislation stemmed from the growth of individual project bills of preceding years and from a Supreme Court decision in 1824. In the famous case of Gibbons *v.* Ogden, Chief Justice John Marshall held that navigable waterways — commerce on the Hudson River was the specific issue — were national highways, under Federal rather than State jurisdiction. The General Survey Act authorized the President to use military and civil engineers to secure surveys, plans, and estimates of roads and canals and navigation improvements of national importance. It was a landmark in the history of the Corps of Engineers. To administer the Act, President Monroe created a Board of Engineers for Internal Improvements which would survey and recommend routes for numerous roads and canals. Among those advocated by the Board were the Chesapeake and Ohio Canal, the Chesapeake and Delaware Canal, a waterway to connect the Kanawha with the James and Roanoke Rivers, and numerous other canals in Maryland and Pennsylvania.[14]

When railroads began to compete with the canals, Congress included them within the provisions of the General Survey Act. Virtually from the beginning, Army Engineers were assigned to assist in railroad construction. In 1827, they conducted a preliminary survey of the routes from the Potomac to the Ohio for the Baltimore and Ohio. The following year, four engineer officers plotted a definite location for the railroad as it pushed out of Baltimore and climbed over the mountains. On the historic day of October 1, 1829, when the first permanent section of track was placed by the B&O, the first put down for passenger service in the United States, the work was done under a Corps officer acting as superintending engineer, Captain George Washington Whistler.

Left. Competitors on Land and Water.
Source: Archives of the Baltimore and Ohio Railroad Museum/Chessie System.

Top Right. Cabin John Bridge in Washington, DC, Under Construction.

Bottom. Cabin John Bridge in Washington, DC, in the 20th Century.



Biographical Sketch

George Washington Whistler

The career of Captain Whistler illustrates how Army Engineers contributed to technological development from within and outside of the Army. Ironically, Whistler, who during his lifetime was one of the foremost engineers in the world, is remembered today primarily because of his family. His son, James Abbot Whistler, painted the famous portrait "Whistler's Mother."

Born in 1800 into an Army family, George Whistler grew up in the Northwestern Territory. He graduated from West Point, married Mary Swift, the daughter of the post surgeon, and entered the Corps of Engineers. He was first assigned to Fort Columbus (now Fort Jay) on Governor's Island in New York Harbor. His talents in drawing and geometry served him well as he made surveys in the early 1820s for military defenses along the New England coast. Captain Whistler solved the dilemma of how to depict on a map the differences in elevation between the shoreline and the terrain commanding it. He used horizontal contour lines to indicate elevation. He was the first person to apply to land maps the contour system which had previously been applied only for depths on nautical charts. Since then his system has been universally applied in topography.

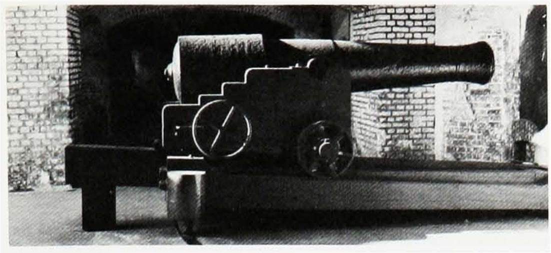
Captain Whistler's fame had just begun. For the next few years, he helped to survey the boundary between the United States and Canada. He probed the wilderness between Lake Superior and the Lake of the Woods. In 1826, he returned to the East and began his career as a railroad builder. A former classmate at West Point secured Whistler's assignment to the B&O Railroad and together they inspected British railroads for the B&O and helped direct the railroad's initial construction. Later Captain Whistler helped supervise construction of the Baltimore and Susquehanna Railroad, the Paterson and Hudson (later part of the Erie Railroad), and the Western Railroad of Massachusetts, which became part of the Boston and Albany Railroad.

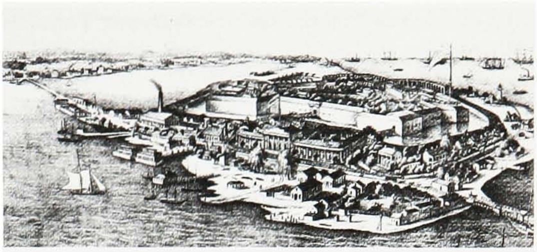
In 1833, Captain Whistler resigned his commission after 14 years as an officer in the Corps of Engineers and became a civilian. He was appointed Chief Engineer for the proprietors of the locks and canals of the Merrimack River which powered the machinery of the giant, new textile mills at Lowell, Massachusetts. In the machine shops there, Captain Whistler designed and built some of the best railroad engines in the United States. In the 1840s, he invented the locomotive whistle as a safety device. He also designed and supervised the construction of a railroad bridge across the Connecticut River at Springfield, one of the first long-span railway bridges in the country. Learning of Captain Whistler's fame, Czar Nicholas I invited him to supervise major projects in Russia. While building the St. Petersburg to Moscow Railroad, Captain Whistler erected the famous bridge over the Neva River and the fortifications at Cronstadt. He died of a heart attack in 1849 before the railroad was completed.[15]

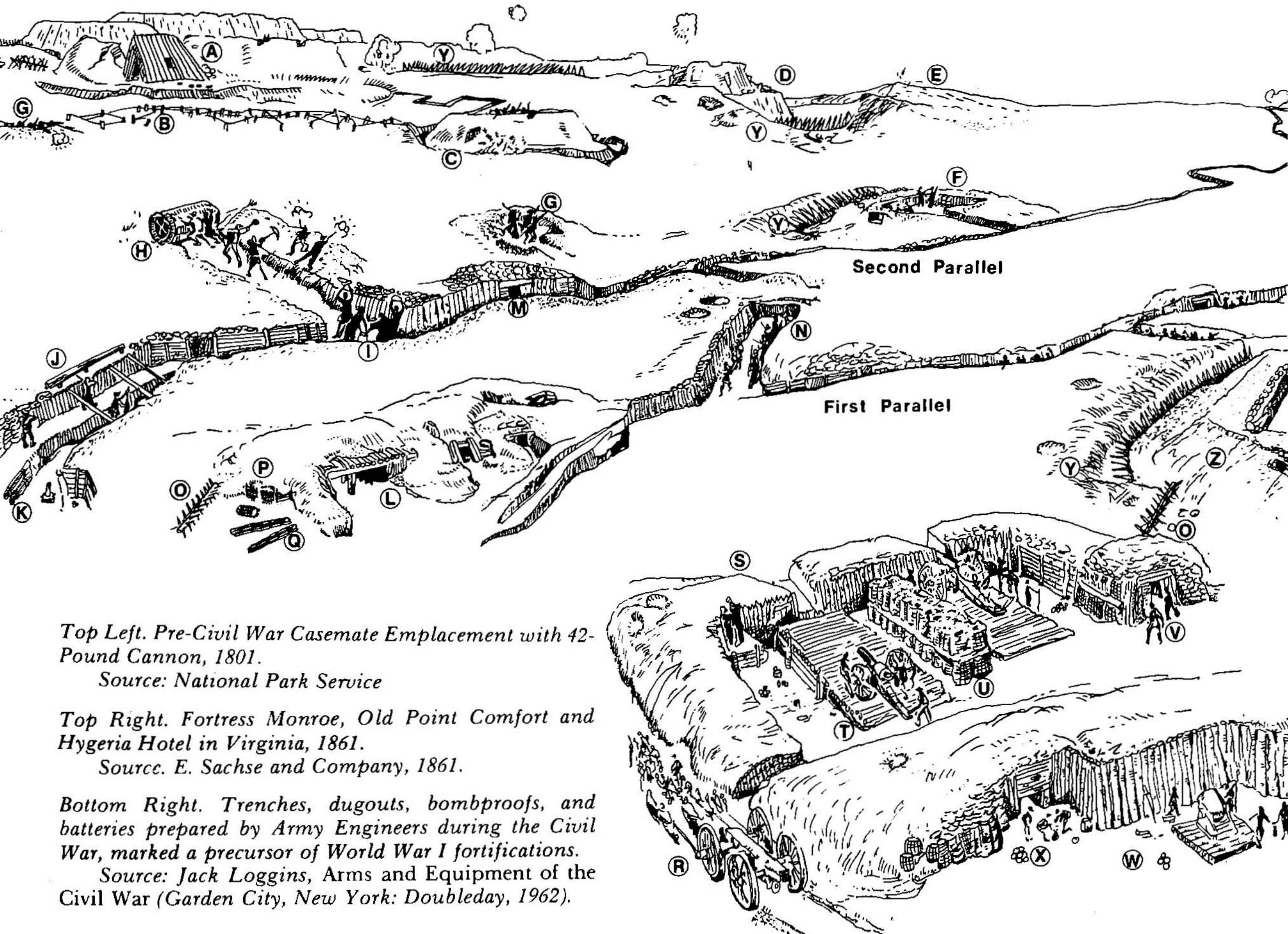
Army Engineers built and frequently managed a number of the early railroads in the United States. The most famous of these in the North Atlantic Region were the Boston and Providence; the Erie; the North Central; the New York, New Haven and Hartford; the Long Island; the Lake Shore parts of the New York Central; and the Southern Railroad.

The Corps of Engineers also became the major builder for the Federal Government. For most of the 19th Century, it built the Nation's lighthouses. Even more prominently, the Corps undertook construction of public buildings and other municipal projects in the Nation's Capital. Army Engineers built the Washington Aqueduct. Part of that water supply system, the Cabin John Bridge, became an engineering landmark. For 50 years, its 228-foot span was the longest masonry arch in the world. Corps' engineers also erected the wings and the 287-foot dome to the Capitol Building in the 1850s and 1860s.

By the mid-19th Century, civil engineering had come of age in the United States. A number of engineering schools opened and the American Society of Civil Engineers was organized in the 1850s. The formation of civil engineering and the standards of the profession had, however, been greatly influenced by West Point and the Corps of Engineers. In addition, by mid-century, the role of the Army Engineers in civil works construction and transportation improvement had been firmly established.[16]







Top Left. Pre-Civil War Casemate Emplacement with 42-Pound Cannon, 1801.
Source: National Park Service

Top Right. Fortress Monroe, Old Point Comfort and Hygeria Hotel in Virginia, 1861.
Source. E. Sachse and Company, 1861.

Bottom Right. Trenches, dugouts, bombproofs, and batteries prepared by Army Engineers during the Civil War, marked a precursor of World War I fortifications.
Source: Jack Loggins, Arms and Equipment of the Civil War *(Garden City, New York: Doubleday, 1962).*

V
Fortifications and Military Engineering, 1815-1888

During the 19th Century, the Army Engineers continued to pursue vigorously their primary mission, the maintenance of the Nation's security. They did this through the construction of coastal fortifications during peacetime and through the support of military field commanders in the Mexican and Civil Wars.[17]

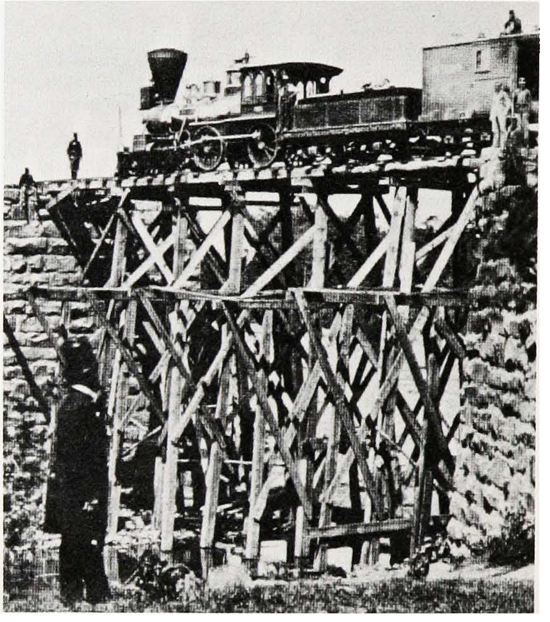
The War of 1812 had demonstrated the effectiveness of defense works like Fort McHenry. During the following 40 years, the Federal Government — employing Engineer officers as supervisors — erected a string of substantial fortresses protecting every major harbor on the Atlantic Coast. The Nation's third fortification system represented a significant departure in the history of warfare. With the completion of the fortifications, the United States became the first country in the world to construct seacoast defense on such a large scale.

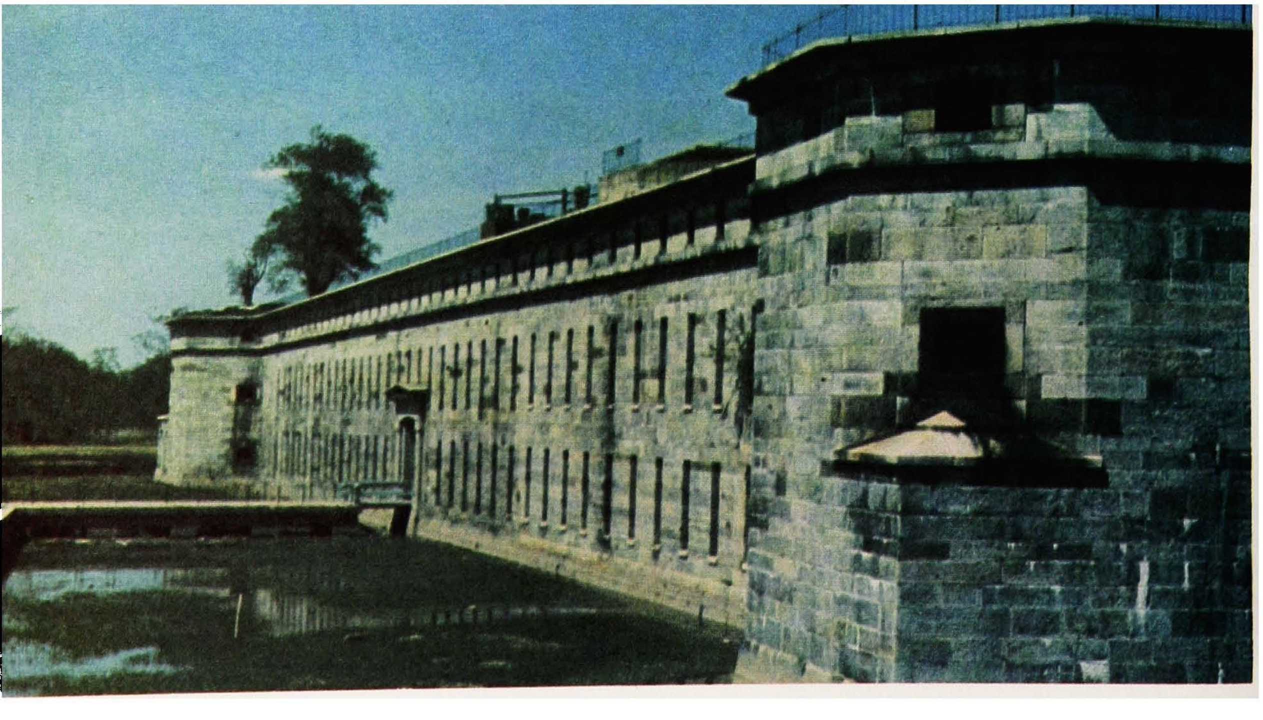
Top Left. 15-Inch Rodman Gun Made During The Civil War.

Source: The National Archives, Washington, DC.

Top Right. During the Civil War, Army Engineers provided the technical expertise necessary to operate a national military railroad.

Bottom. In the years before the Civil War, Engineers built Fort Delaware on Pea Patch Island, hardly more than a mound of mud in the middle of the Delaware River between Philadelphia and Wilmington. Through an ingenuous use of pilings, the Engineers provided a firm foundation for the fortification. It served as a Civil War prison. In the 20th Century, concrete emplacements were added for 16-inch coastal artillery rifles.

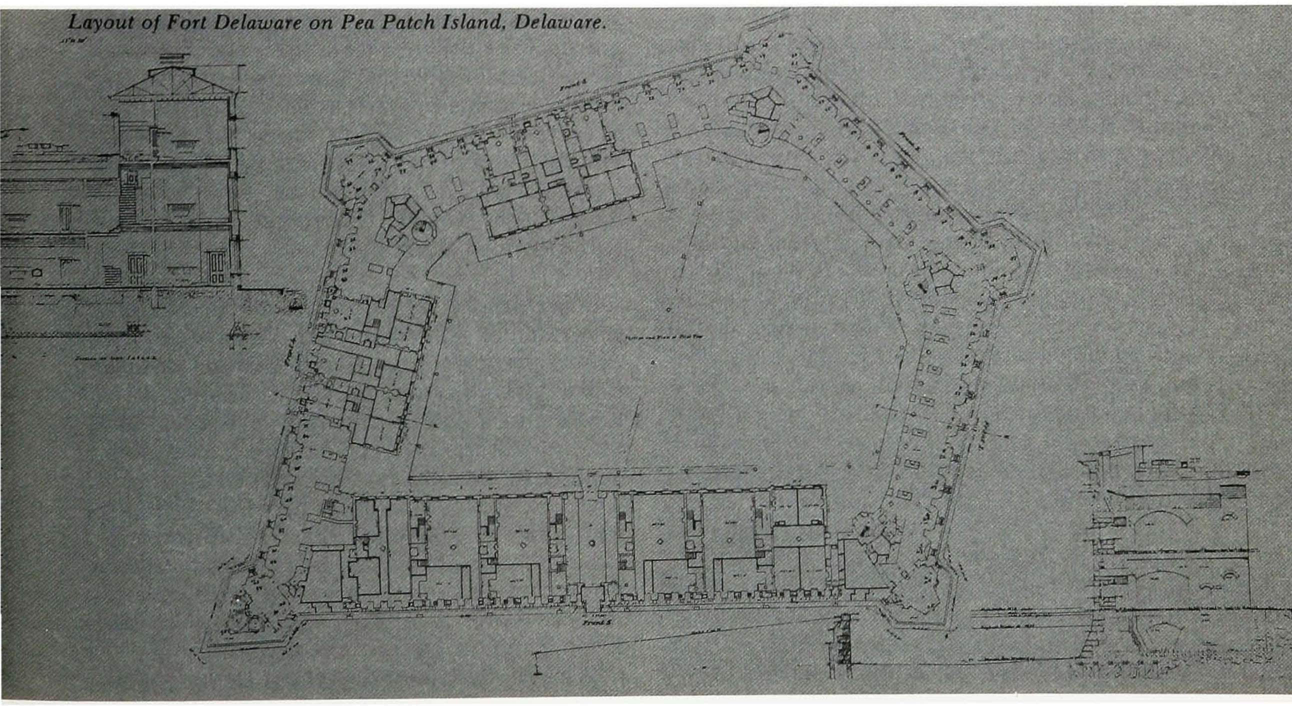




Unlike the first two fortification systems, the one that began in 1816 represented neither emergency nor episodic construction. Instead, it was a continual, long-range program of National Defense. The War Department created a Board of Engineers for Fortifications to select sites and oversee construction by private contractors. The comprehensive seacoast defense system that they devised consisted of more than 30 new forts, two-thirds of them clustered around the principal harbors along the coastline from Maine to Virginia. Engineers modernized or replaced many earlier works and constructed several forts on new locations. These new works, like Fortress Monroe, a self-sufficient island fortress at Hampton Roads, Virginia, included some of the world's most spectacular examples of military architecture. Built of brick and stone, these fortresses housed multiple tiers of weapons, accommodating many more guns than any previous fort. Some of them held as many as 400 guns. Polygonal external walls, at least four feet thick, included narrow casemate emplacements, occasionally mounted with protective iron shutters. So well were these red-brick, multi-tiered fortresses constructed that most of them still stand. They represent the oldest surviving body of major military structures in the United States.

Improvements in armaments increased the effectiveness of the new fortification system. The primary weapons continued to be smoothbore, muzzle-loading cannon firing explosive shells or spherical projectiles of solid iron. When heated and ricocheted across the water, these "hot shots" set fire to the hulls of wooden ships. In the 1830s, the size of the cannon and their projectiles increased as the 24-pounders were replaced with 32-pounders and later 42-pounders. In the 1840s and 1850s, technological developments led to the introduction of a versatile new weapon known as the Columbiad, which discharged a 64- to 125-pound shot. The bore of the Columbiad was of 8- or 10-inch caliber, using the new system then being adopted of measuring weapons by the diameter of their bores rather than the weight of their projectiles. Even more importantly, they could fire at angles up to 40 degrees, which tripled their range to three miles. They could destroy enemy ships before the naval gunners could return the fire. The Army's Thomas Rodman developed a balloon-ended cannon known as the Rodman gun which was built in 8-, 10-, and 15-inch calibers. It became the standard seacoast weapon during the Civil War and for 20 years afterwards.

Although it offered substantial protection against potential foreign enemies in the 19th Century, the third fortification system proved of little value in the Nation's two major mid-



Layout of Fort Delaware on Pea Patch Island, Delaware.

century wars. The Mexican War was fought primarily outside the United States and the Civil War represented an internal conflict rather than an external attack. The sudden seizure of the forts by domestic forces had been an unforeseen contingency in the long-term planning of the fortification system. Early in 1861, Confederate troops captured all but three of the major fortresses south of Hampton Roads. During the war, the forts north of Norfolk remained in Union hands, but few of them fired a hostile shot. Instead, many, like Forts Delaware, Mifflin and Hamilton, became prisoner-of-war camps; others, like Fort Schuyler, served as Army hospitals.

In a war already on American soil, Army Engineers immediately concerned themselves with protecting the Nation's Capital. Quickly, they erected extensive earthwork defenses around the District of Columbia. They built a series of 68 earthen forts and batteries and connected them through 20 miles of rifle trenches. They established nearly 1,200 gun emplacements behind the lines and constructed 30 miles of military roads which provided a communication and transportation network for the defenders. This system helped protect Washington from attack even though it was situated well within the South. The Confederates erected similar field fortifications around their capital of Richmond.

In support of the Union, Army Engineers performed a number of valuable tasks. They built temporary bridges so that the Northern armies could get across the many rivers which pierced the South. Ingeniously, they devised special pontoon boats — floatable wagons on wheels — which proved effective and remained standard military bridge equipage for decades. As a part of the coastal defense system, Army Engineers developed submarine mines, torpedoes, and steam-powered rams, which sank or disabled some 40 ships. On land, they mapped most of the South which had been largely unplotted before the war. They reconnoitered enemy positions on horseback or from observation ballons, selected routes of march and attack, chose campsites, developed field-works of earth, sandbags, and logs, and employed mining and other siege techniques against the enemy's earthworks. Field fortification and siegecraft reached a degree of complexity and intensity in the trench warfare around Petersburg, Virginia, at the end of the war that remained unequaled until World War I.

Fortification and harbor defense went through a transition period after the Civil War. The antebellum forts became obsolete. Steampower gave warships better tactical mobility and lessened the exposure of their means of propulsion as propellers replaced sails. Iron armor reduced their vulnerability to shore fire. At the same time, their own firepower increased. Rifled artillery made ships' guns more accurate and enabled them to deliver heavier shells which could reduce masonry walls to rubble. Consequently, harbor defenses underwent a marked changed. Army Engineers studied the feasibility of covering existing masonry walls with iron armor, but the cost was considered too great in a period of reduced military spending. Although several European nations built iron turret coastal defenses, the United States turned back to earth and sand for inexpensive and easily repaired fortifications.

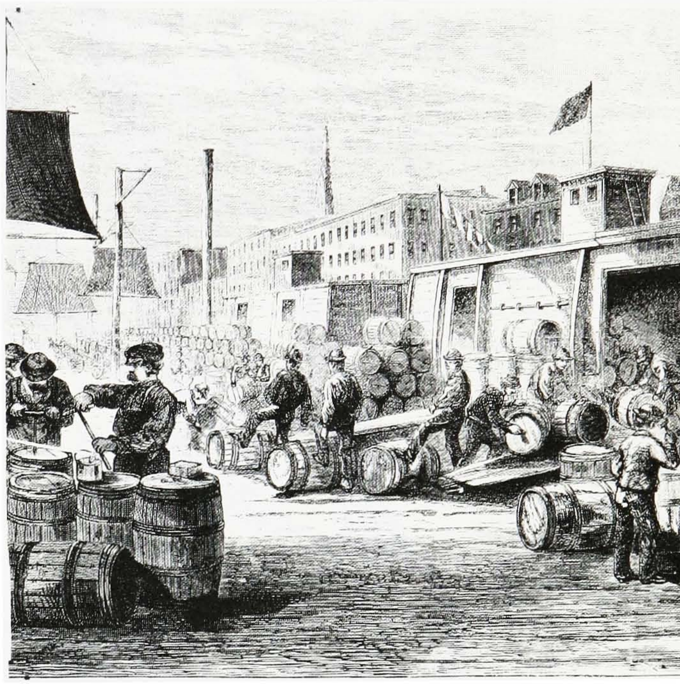
The new, large caliber rifled weapons expected to be perfected shortly would make the old forts too vulnerable. Therefore, beginning in the 1870s, work commenced on a number of barbette batteries. Smaller than the old forts, but larger than previous earthworks, these batteries consisted primarily of earthwork parapets with gun platforms and ammunition storage rooms of concrete and granite. For the first time since the American Revolution, dispersed batteries served as the main elements of harbor defense rather than as accessories to larger forts. In the new system, defensive armament would be scattered in a number of comparatively inexpensive works distributed around the entrance to a harbor.

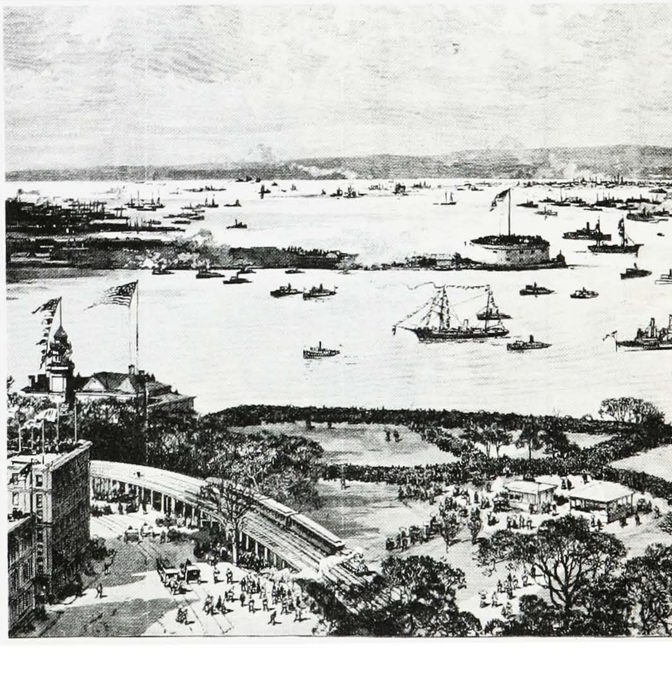
Work began in 1875 on a fairly extensive program of supplemental defenses, large-caliber mortars, mines, and channel obstructions. This program proved to be short-lived. It came to a halt within five years because of lack of funds and the failure of ordnance experts to develop reliable, large-rifled guns. The new weapons did not become technologically feasible until the 1890's. In the meantime, most of the batteries constructed by the Engineers remained equipped with existing smooth-bore weapons, generally 15-inch Rodman guns. Despite the temporary lag, the post-Civil War period marked the end of the

Top Right. New York Harbor, 1873.

Center Right. Flour Docks, New York Harbor, 1873.

Bottom Right. Fourth of July Celebration, showing Fort Jay in the New York Harbor, 1884.





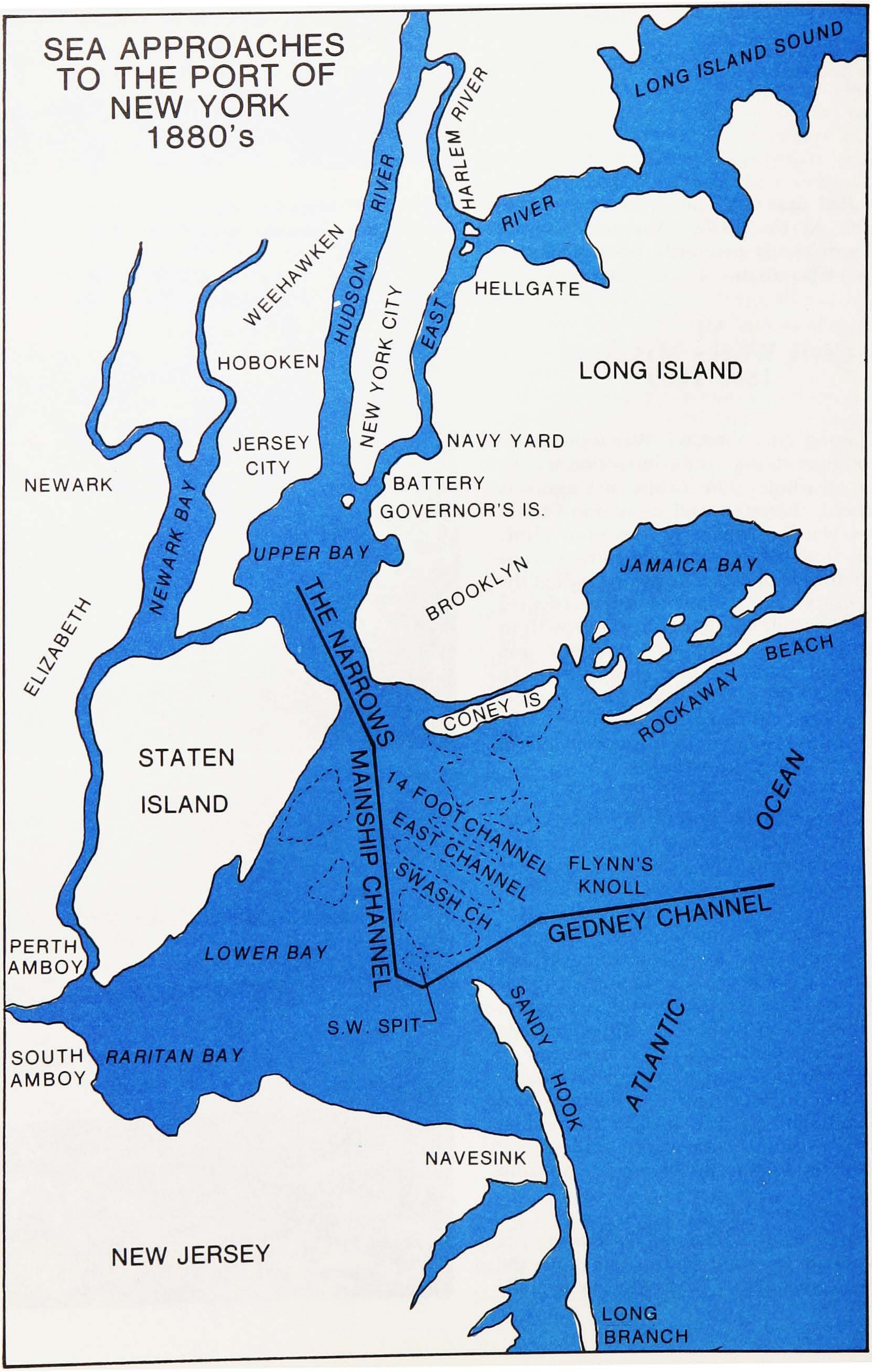
high-walled masonry and brick forts. From the 1870s to the 1940s, American coastal defense would rely primarily upon dispersed batteries rather than compact fortresses.

VI
Civil Works Missions 1865-1885

The period after the Civil War represented a time of great change and contraction for the Army as a whole. The Corps of Engineers experienced alteration and reduction in size from its wartime force. At the same time, however, it added new tasks and missions as the economy expanded. The second half of the 19th Century was a time of unprecedented urban, industrial, and agricultural growth in the United States. America's domestic and international trade swelled enormously. In maintaining the waterways and harbors which handled much of that commerce, the Army Engineers played an important role in fostering economic growth.[18]

A number of changes occurred in the Corps of Engineers after Appomattox. Reorganization of the Army in 1866 terminated exclusive engineer supervision of West Point. Consequently, the Corps established its own graduate school in engineering. Located at Willets Point, New York, on Long Island Sound, the school developed on an Army post later renamed Fort Totten. During succeeding years, this base provided facilities for the service school, barracks for the battalion of enlisted engineers, and a center for experimentation in engineering design and construction. It served as a place to conduct experiments with submarine mines, the torpedoes and other underwater demolition devices.

As part of the general redrawing of administrative lines within the Army after the Civil War, the Corps of Engineers in 1866


SEA APPROACHES
TO THE PORT OF
NEW YORK
1880's
LONG ISLAND SOUND
HARLEM RIVER
HUDSON RIVER
EAST RIVER
WEEHAWKEN
NEW YORK CITY
HELLGATE
HOBOKEN
LONG ISLAND
JERSEY CITY
NAVY YARD
NEWARK
BATTERY
GOVERNOR'S IS.
NEWARK BAY
UPPER BAY
JAMAICA BAY
BROOKLYN
ELIZABETH
THE NARROWS
BEACH
CONEY IS
ROCKAWAY
STATEN
ISLAND
MAINSHIP CHANNEL
14 FOOT CHANNEL
EAST CHANNEL
SWASH CH
OCEAN
FLYNN'S
KNOLL
GEDNEY CHANNEL
PERTH
AMBOY
LOWER BAY
S.W. SPIT
SANDY HOOK
SOUTH
AMBOY
RARITAN BAY
ATLANTIC
NAVESINK
NEW JERSEY
LONG
BRANCH

established a number of Engineer Districts as permanent administrative subdivisions. These decentralized operating agencies had evolved in an informal manner before the war. In the postwar period, the Chief of Engineers gave them official recognition and formal structure. Each District Engineer supervised not only his own District office but project and area offices as well. He reported directly to the Chief of Engineers in Washington, D.C. Among the Districts in the North Atlantic Region, a Philadelphia District office had been established about 1825, New York around 1834, and Baltimore in approximately 1848. These three became officially recognized as Engineer Districts in the reorganization of 1866. Washington, D.C. began a District in 1874 and Norfolk in 1878.

Decentralization made it easier and more efficient for the Army Engineers to cope with the unprecedented expansion of navigation improvement work in the last third of the 19th Century. In the Rivers and Harbors Act of 1866, Congress directed the Corps to review all prewar waterway projects and to plan additional programs. During subsequent years, the size and number of Corps supervised civil works projects increased. In 1869, Congress appropriated $2 million for work on 48 river and harbor projects. In 1880, it authorized $9 million for 343 projects. This appropriation represented 3 per cent of the Federal Budget that year. In the last third of the 19th Century, the Federal Government spent $333 million on improvements to the Nation's waterways.

A number of developments stimulated this extensive navigational improvement work. The expanded traffic generated during the Civil War had demonstrated the need to keep the waterways open. Waterborne commerce provided a less expensive alternative to the railroads for shipping freight. After the war, municipal groups and farmer-shippers exerted strong political pressure for alternatives to counter high railroad rates.

With the defeat of the South, effective opposition to Federally-aided internal improvements declined. Northern-dominated administrations used part of the revenue from high protective tariffs for navigational improvement. The Federal Government aided land transportation through the construction of transcontinental railroads. It assisted waterborne commerce by helping to maintain canal, river and labor facilities. An effective transportation network benefited both National prosperity and defense.

The Corps' helped to maintain the navigability of waterways in the North Atlantic Region. The Army Engineers had hired dredging contractors and had maintained channels in major rivers and harbors since the early 1800s. Beginning in 1855, however, when the *General Moultrie* was commissioned, the Corps also employed its own ladder and suction dredges in this work. In the last third of the 19th Century, the Corps obtained channel dredging and clearance to depths of between 22 and 30 feet in the Hudson and Delaware Rivers and in the busy seaports of New York, Philadelphia and Baltimore. The channels had to be widened and deepened in order to handle the increased volume of traffic and the larger steel-hulled steamships and warships which came into service in the 1880s. These vessels had drafts of 20 to 24 feet, several feet more than those of the prewar period. Beginning in 1885, the Corps instituted dredging on major waterways on a regular annual basis rather than sporadically as in the past. In this period, the engineers also removed rocks and shoals to improve navigability. They constructed a new breakwater at the entrance of Delaware Bay to provide shelter for vessels at the Delaware Capes. Furthermore, they built several lighthouses as the Federal Government improved the sea lanes and access to the Nation's harbors.

In addition to navigational improvement on the waterways, the Army Engineers constructed a number of government structures on land. In the District of Columbia, the Corps oversaw the building of the Washington Aqueduct and all public works and improvements in the Nation's capital. They supervised the construction of the Library of Congress, the old State, War and Navy Building, the old Post Office Building, the Municipal Building, the Government Printing Office, the old Army War College, the Department of Agriculture Building, the Lincoln Memorial, and the completion of the Washington Monument.

Officers of the Army Engineers also supervised the erection of many government structures outside the District of Columbia. These included such historic monuments as

Pilgrim's Landing at Provincetown, Massachusetts and the Memorial Arch at Valley Forge, Pennsylvania. Following their success with the Washington Aqueduct, they directed construction of water supply systems for Philadelphia and New York City. They also built customhouses, post offices, and marine hospitals in various cities.

VII
Conclusion

The first century of the Corps of Engineers activity in the North Atlantic Region had been a formative one. The organization emerged, achieved recognition and permanence, and went through a number of changes as the Army Engineers responded to changes in the country. Born of British and French heritage, the Corps of Engineers, like the Nation itself, gradually achieved its independence and established its own tradition. By the early 19th Century, engineering in America had shucked off foreign dominance. A continuing American organization was created in the Corps of Engineers. To prepare Army Engineers and other officers for their tasks, the Government established an institution, the U.S. Military Academy at West Point.

The engineers' skills proved valuable for National defense through the construction of fortifications and provision of engineering support for military commanders in the field. In peacetime, the engineers demonstrated their ability to assist the economy by applying their skills to the growth of a transportation network. Both the region and the Corps benefited from these valuable functions, as local groups and the National government recognized. Between 1775 and 1888, the Army Engineers came to be seen as a valuable asset to the North Atlantic Region, an asset which would continue to grow as the years passed.

CHAPTER 2.

The Division Emerges, 1888-1920

I
Introduction

The United States became a major urban, industrial Nation and world power during the years that ushered in the 20th century. Industry boomed, commerce grew, cities burgeoned. The Nation added new territories in the Caribbean and the Pacific and engaged in European rivalries. Since such expansion often meant conflict, the Government modernized the Armed Forces and the coastal defenses.

Adjusting to the new conditions, the Corps of Engineers kept abreast of these developments. Its missions of civil works and military construction expanded as the Nation grew at home and abroad. In the northeastern United States, the Army Engineers played an important role. They bolstered seacoast fortifications and, during World War I, helped to supply the American Expeditionary Force that was sent to France. They kept the region's major waterways adequate for the needs of the increased commerce which accompanied the industrial expanson. To help meet these new demands, the Corps reorganized its structure to include regional administrative agencies, including the immediate predecessors of the North Atlantic Division.

II
Regional Engineer Divisions

A multi-level organizational structure could more effectively administer the Corps' growing civil works activities. Engineer Districts had proliferated in the 19th Century, increasing their workloads over the years. In 1888, the Chief of Engineers decided to establish regional Engineer Divisions to oversee the work of these Districts. The resulting three-level administrative structure has remained an integral part of the decentralized framework of the Corps of Engineers from that time to the present.

To a certain extent, the middle-level Divisions had been evolving even before the Chief of Engineers recognized them officially and gave them formal structure in 1888. Following the Civil War, a few engineer officers had supervised projects in clusters of states. In effect, they acted as regional administrators between the Districts and the Office of the Chief of Engineers. For example, for 20 years after the war, Colonel Quincy A. Gillmore had supervised civil works and military construction from North Carolina to Florida from his headquarters in New York City. He also oversaw a number of engineering projects in New York and Connecticut. From Baltimore, Colonel William P. Craighill held responsibility for much of the Army Engineers' work in Maryland, Virginia, West Virginia and part of North Carolina. Colonel Gillmore's death in 1888 led to a formal reorganization of this regional structure.[1]

In an order dated November 8, 1888, Brigadier General Thomas L. Casey, the Chief of Engineers, created five Engineer Divisions within the United States. He instructed the Division Engineers to "exercise care and oversight over the engineering works of officers within their division. . . "[2] He wanted them to inspect engineering projects annually. Division Engineers would advise, and in emergencies they could direct, the District Engineers. In general, however, they would serve as supervisors of the Districts' work and they would channel communications between the Districts and the Office of the Chief of Engineers.

Originally, two Engineer Divisions received jurisdiction over the North Atlantic Region. The Northeast Division, with headquarters in New York City, ranged from Rhode Island to northern New Jersey and west to include eastern Ohio. The Southeast Division, based in Baltimore, extended from southern New Jersey

through Georgia. Jurisdiction changed in a number of reorganizations over the next 30 years.

A major change in jurisdiction came in 1903 when most of the territory of the Southeast Division was removed from the current area of the North Atlantic Division. A shortlived Chesapeake Division replaced it for a few years. In 1908, a new agency, the Eastern Division was created and shared supervision of the region with the Northeastern Division foı the next two decades.[3]

Primary responsibility for making the new administrative system work fell upon the first Division Engineers. Colonels Henry L. Abbot of the Northeast Division and William P Craighill of the Southeast Division became the first men responsible for the area now covered by NAD. Colonel Abbot's career in the Corps illustrated the growth of the missions of the Army Engineers in the years between the Civil War and World War I. He may be properly considered the first North Atlantic Division Engineer.

Biographical Sketch

Henry Larcom Abbot

Division Engineer, 1888-1895

Henry Larcom Abbot became one of the leading American engineers of the late 19th and early 20th Centuries. Born in 1831, the son of a high school principal in Beverly, Massachusetts, he came from a family whose members had fought in the French and Indian War and the American Revolution. Following his graduation from West Point in 1854, Abbot laid out a railroad route between California and Oregon as a member of the Topographical Engineers. After a survey of the Mississippi River Delta in the late 1850s, he and Captain Andrew A. Humphreys made suggestions for channel improvements and flood protection in their report entitled *Physics and Hydraulics of the Mississippi River.* The work remains today as one of the most authoritative documents ever published on the Mississippi River problems.

During the Civil War, General Abbot showed his prowess as both an engineer and an artillery officer. While serving as chief topographical officer for General Tyler's Infantry Division, he was wounded at the first battle of Bull Run. After recovering, he assisted in the fortification around Washington and the construction of field-works in the Peninsular Campaign. In 1864 and 1865, he commanded the siege train for the Union armies operating against Richmond and Petersburg, Virginia. Brevetted (that is, given the honorary rank but without an accompanying increase in pay) as a Major General in the U.S. Volunteers, he commanded the artillery in the largest amphibious assault of the war, the capture of Fort Fisher at Wilmington, North Carolina in January 1865. He became a Brevet Brigadier General in the U.S. Army in 1865. In all, General Abbot received seven brevets for gallantry and meritorious services in both the U.S. Volunteers and the U.S. Army during the war.

In the postwar years, General Abbot became a prominent authority on coastal defenses. For nearly 30 years, he commanded the Post and Engineer Depot at Willets Point, New York. From that position, he organized the Engineer School, oversaw the construction of Fort Schuyler and led the Engineer Battalion. He served on the Board of Visitors to the U.S. Military Academy, the Board of Engineers for Fortifications, the Board of Engineers for River and Harbor Improvements, and the Board of Ordnance and Fortification. His greatest fame came from his work on underwater mines. After an inspection of mine defenses in Europe in 1873 and following several years of experiments on Long Island Sound, General Abbot designed a submarine mine defense system. The United States adopted it in 1881.

In 1888, General Abbot, then a colonel, was appointed the first Division Engineer of the Northeast Division. He remained in that post for seven years, continuing his duties on a number of the many engineer boards at the same time. He retired as a brigadier general in 1895 at the age of 64.

Retirement from the Army neither impeded General Abbot's engineering activity nor diminished his reputation. As a civilian engineer, he designed harbor improvements at Manitowoc, Wisconsin, and served as a consultant to the Pittsburgh Chamber of Commerce. As a consulting engineer for the

French Panama Canal Company in the 1890's, he began a study of the route ultimately selected for the isthmian canal. When the United States took over the canal project, President Theodore Roosevelt solicited his advice. For five years, Abbot served as a Professor of Hydraulic Engineering on the graduate faculty of George Washington University. His final public service came in 1915 when, at 84, he served on a committee appointed by President Woodrow Wilson to investigate a landslide which had closed the Panama Canal for several months.

General Abbot spent his last years at Cambridge, Massachusetts. He died there in 1927 at the age of 96, the oldest graduate of West Point at the time. His son, Brigadier General Frederick V. Abbot, who served as Division Engineer of the Northeast Division from 1913 to 1917 and as Acting Chief of Engineers between 1919 and 1920, died the following year at the age of 70.[4]

Brevet Brigadier General Henry Larcom Abbot, Division Engineer, North Atlantic Division, 1888-1895.
Source: The National Archives, Washington, DC.

General Orders
No. 93

Headquarters of the Army,
Adjutant General's Office,
Washington, November 8, 1888

By direction of the Secretary of War the following additional paragraphs of the Regulation are published, and will be numbered 2475-1/4 and 2475-1/2, respectively:

2475-1/4. Under the direction of the Secretary of War as many officers, not below the rank of Lieutenant Colonel, as may be necessary may be assigned by the Chief of Engineers as division engineers, through whom all matters connected with engineering project, plan, and construction shall be submitted by district offices within the division to the Chief of Engineers, and through whom the orders of the Chief of Engineers upon the same subjects will be communicated. The extent of each division to be determined by the Chief of Engineers.

2475-1/2. The division engineers will exercise care and oversight over the engineering works of officers within their divisions; will inspect the works at least once a year; will counsel, advise, and in case of emergency direct the district officer in matters pertaining to the engineering work in his charge; and will promptly report to the Chief of Engineers their action in each case, with such recommendations as to them may seem proper. In the performance of this duty each division engineer will be allowed a clerk, to be paid pro rata from the appropriations of the work within their respective divisions, and the traveling expenses of the division engineer will be paid from the same sources.

By Command of Major General Schofield:

R.C. DRUM
Adjutant General

Official :
C.W. Keeser
Assistant Adjutant General

COPY

APPENDIX 2B

HEADQUARTERS, CORPS OF ENGINEERS,
UNITED STATES ARMY,
Washington, D.C., December 3, 1888.

GENERAL ORDERS
No. 12.

By direction of the Secretary of War, and in accordance with Paragraph 2475¼, General Regulations of the Army, 1881, the following officers of the Corps of Engineers are hereby assigned as Division Engineers:

Colonel Henry L. Abbot as Division Engineer of the Northeast Division, which will embrace the districts at present in charge of Major Overman, Major M. B. Adams, Major Livermore, Captain Mahan, Captain Palfrey, and Captain Casey, Corps of Engineers.

Colonel William P. Craighill as Division Engineer of the Southeast Division, which will embrace the districts at present in charge of Captain Bixby, Captain Black, Captain Abbot, Lieutenant Fiebeger, and Lieutenant Carter, Corps of Engineers. Mr. S. T. Abert, and Mr. W. F. Smith, U. S. Agents.

By command of Brig. Gen. Casey:

/s/ Clinton B. Sears

Captain of Engineers, U.S.A.

Until made discretionary in 1915, the mandatory annual inspection tours formed an essential part of the Division Engineers' duties. The reports on these investigations reveal much about the Division Engineers' conception of their function as well as the kind of work Army Engineers performed.

They show a desire to protect the long-range public interest in navigable waterways against corporations and individuals who sought immediate benefits from construction which encroached on the waterways. In 1890, Colonel Abbot and his District Engineer sought to prevent several railroads from extending their iron and coal piers and other docking facilities into the congested harbor of Ashtabula on Lake Erie.[5] Division Engineers paid careful attention to the status of dredging and the construction. In 1903, Colonel Amos Stickney, who was then Eastern Division Engineer, found the timber work of the main breakwater at Oswego greatly decayed. However, he concluded that the amount of commerce of the port did not justify the $1 million it would cost to rebuild the structure. Instead, he recommended short term repairs.[6]

A description of Corps of Engineers' dredging to maintain channel depths in the Delaware River in 1904 reads as follows:

On July 26th, we visited the dredge "Hell Gate," working to remove the mud overlying the rock of Schooner Ledge. This dredge is in good working order, with a new six-yard dipper, and is doing good work, but not nearly up to her capacity on account of having but two dump scows, which are towed some distance up river to Ridley Park where the material is dumped, to be pumped up on the meadowland by an hydraulic dredge.

. . .Colonel Amos Stickney, Eastern Division Engineer, report to the Chief of Engineers, August 31, 1904.[7]

The quality of construction projects was scrutinized by Division Engineers on their annual inspection tours. In 1895, Colonel John M. Wilson, Northeast Division Engineer, visited the fortifications on David's Island in Long Island Sound. He warned that the inadequate sod revetment on the steep interior slope of the parapet would probably be dislodged and slide after the first violent storm. As a remedy, he suggested that the angle of the slope be greatly diminished. Such a method had proven effective in similar batteries in San Francisco.[8] In 1902, Colonel Charles R. Suter, Northeast Division Engineer, criticized the particular placement of three-inch rapid-firing guns overlooking Narragansett Bay. The positioning had been recommended by Newport District Engineer, Major George Washington Goethals, the Army Engineer who a few years later would be hailed as the builder of the Panama Canal. Colonel Suter noted that the placement was open to enfilade fire and that the weapons were unprotected by parapets.[9] Although critical of inadequate performance, Division Engineers were quick to applaud innovative and particularly fine work. In 1893, Colonel Abbot praised one of the engineer officers at Willets Point for developing a new revolving concrete mixer which increased the speed and reduced the cost of preparing the material from $5.00 to $3.61 per cubic yard.[10]

The organization, procedures and financial situation of District Offices came under supervision by the Division Engineers. These officers sought to ensure, for example, that the remuneration of the civilian staff members was adequate and proper. By 1901, they had standardized rates of pay for various grades of civilian employees.[11] On his tour of the Wilmington, Delaware District Office in 1904, the Division Engineer recorded that the monthly salaries for the civilian staff totaled $1,048 broken down in the following manner:

Wilmington, Delaware District Office 1904

Position	**Monthly Salary**
1 chief clerk	$175
1 clerk	116
1 clerk	74
1 draftsman	125
1 messenger	50
1 asst. engineer in charge of fortifications	225
1 asst. engineer in charge of rivers and harbors (except Wilimington Harbors)	150
1 junior engineer in charge of Wilmington Harbor and wrecks and bridges	133
Total	$1,048

In addition, operating costs at the Wilmington District included coal, ice, stationery, drawing materials, and $78.00 per year for telephone service on the single instrument in the four-room office. Rent was not included because the District offices were located in the Federal Building. As at the other Districts he visited that year, the Division Engineer, Colonel Stickney, found "the office and its records appeared to be well ordered and administered with due economy."[12]

Division Engineers played an important role in the Corps' administrative structure. In addition to the inspection tours, they provided supervision and advice to District Engineers and supplied information and opinions to the Chief of Engineers. They helped to coordinate the work in the various Districts in their Division. From their own experience, they provided an overview and perspective generally broader than that of most District Engineers. Nevertheless, the work of the Division Office in these early years remained relatively light compared to what it would become by the middle of the 20th Century. The workload could be accomplished by the Division Engineer and a few clerks, often fewer than half a dozen persons in all. As late as World War I, therefore, Division Engineers frequently also served as District Engineers at the same time.

To provide an independent source, above the District and Division level to review projects, Congress created a Board of Engineers for Rivers and Harbors in 1902. The process of investigation and approval of specific civil works projects thus progressed from the District Engineer's initial report to review by the Division Engineer, the Board of Engineers for Rivers and Harbors, and then the Chief of Engineers before being forwarded to Congress by the Secretary of War.

III

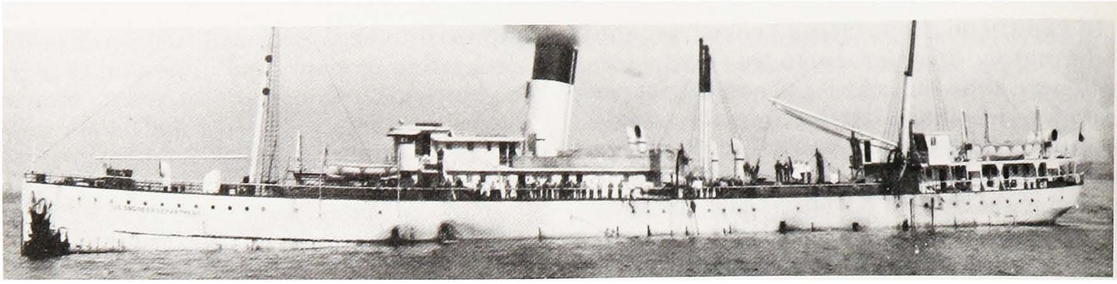
Traditional Civil Works

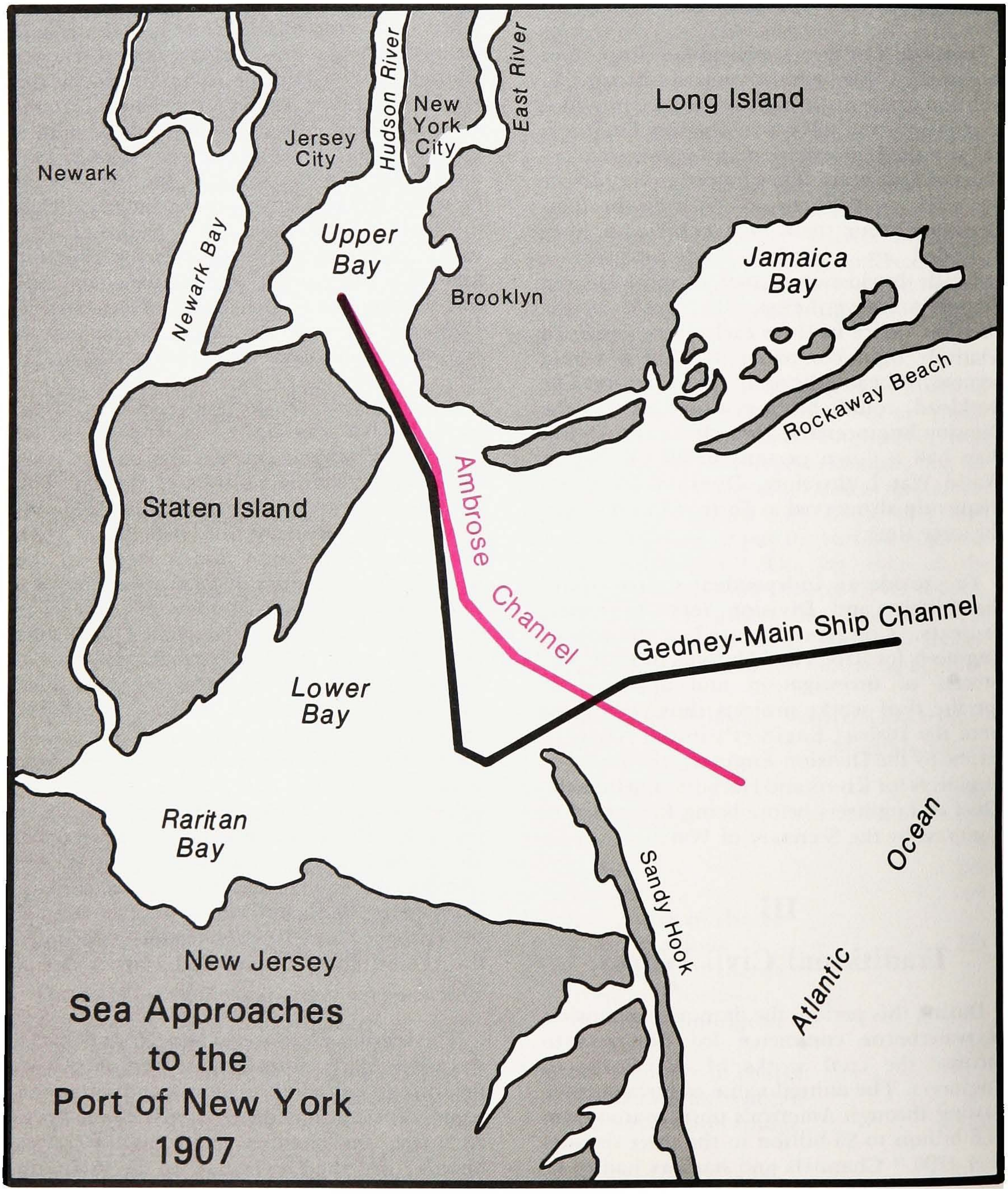
During this period, the dramatic expansion of waterborne commerce led Congress to increase the civil works of the Corps of Engineers. The annual value of foreign trade passing through America's ports soared from $1.6 billion to $6 billion in the three decades after 1890.[13] Channels and harbors had to be improved to keep pace with the needs of the accelerating economy and important changes in shipping. Congress increased annual Federal expenditures for river and harbor work from $7 million to $47 million in those 30 years.[14]

A revolution in the size of ships occurred in this period. Modern ocean liners arrived. These steel ships were powered first by coal-fed steam turbines and later marine diesel engines. The *Great Eastern*, the first structural steel steamship, had a gross tonnage of 18,900 and a 30-foot draft. It laid the Atlantic cable in the late 19th Century. By 1903, the British Cunard Line began building passenger ships with a gross tonnage of 32,000 and more than 30-foot draft. The *Lusitania* and the *Mauretania* exceeded 800 feet in length. In the late 1890's the depth of the harbors at New York and other major ports did not surpass 24 feet, but the giant new ships required anchorages, channels and turning basins with depths of 35 to 40 feet. Congress directed the Army Engineers to accomplish the deepening of these waterways.

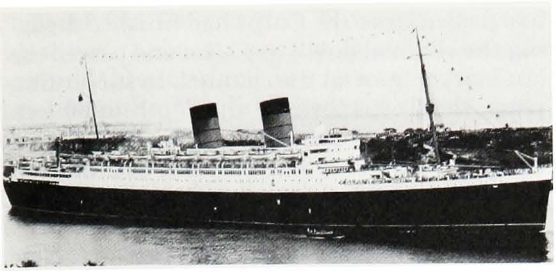
Improvement of the approaches to New York Harbor, especially the creation of the Ambrose Channel, proved one of the most important dredging projects of the era. The new channel took its name from John W. Ambrose, a director of the New York Merchants Association and a leader in the movement to obtain a deeper, wider entrance to the port. Although its share of waterborne commerce began to decline in the 1870s under challenge from Philadelphia, Baltimore and Norfolk-Newport News, New York remained the Nation's busiest port for total volume of foreign and domestic commerce.[15] Faced with the necessity of handling the giant liners of the transatlantic trade, shipping companies and other maritime interests of New York petitioned Congress for harbor improvements. These local interests modernized the terminal and docking facilities. John Ambrose won his decade-long battle for Federal improvement of the harbor channels when Congress included the project in the River and Harbor Act of 1899.[16]

The regular entrance to New York Bay, the so-called Main Ship-Bayside-Gedney Channel, proved a shallow, tortuous, and dangerous route. The natural depth across the bar was 23.7 feet; the channel width was 500 feet. Shoals filled the Lower Bay. In the 1880s, the





Sea Approaches to the Port of New York 1907



Top Far Left. The Corps of Engineers' Seagoing Dredge Atlantic, *1933.*
Source: The National Archives, Washington, DC.

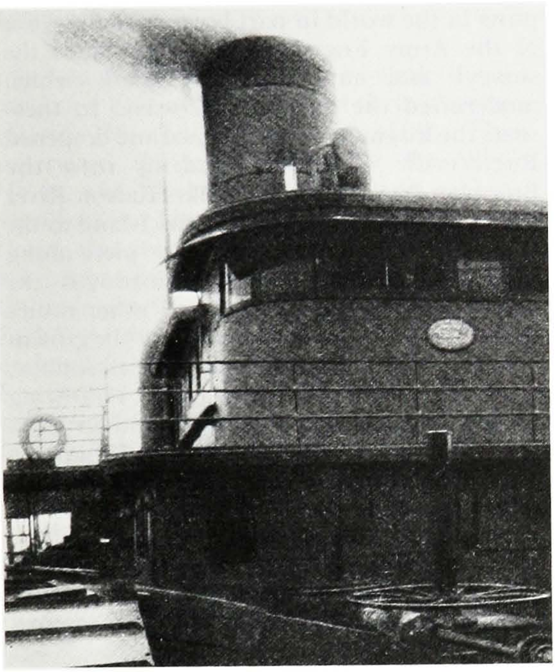
Bottom Far Left. The Ambrose Channel dredged by the Corps of Engineers in the early 1900s, provided a more direct route through the entrance to the Lower Bay of New York Harbor. It replaced the more contorted Gedney-Main Ship Channel which had been used since before the Civil War.

Top Left. The Mauretania. *One of the Cunard Line Giants.*
Photograph courtesy of the Cunard Ship Lines.

Above. Old Ambrose Channel Lightship and New Ambrose Offshore Light Structure, 1967.
Source: U.S. Coast Guard.

Center Left. Wheelhouse of Dredge Atlantic.

Bottom Left. Crew Member Tending Bin Gates on the Dredge Atlantic.



Army Engineers worked to improve the Main Ship Channel, dredging it to a depth of 30 feet and a width of 1,000 feet and extending ten miles from the sea into the Bay. In 1896, Congress directed the engineers to determine whether it would be feasible to deepen the main ship channel to 35 feet. Lieutenant Colonel William Ludlow, the New York District Engineer, made a survey under the supervision of Colonel George L. Gillespie, the Northeast Division Engineer. In his report of 1898, Colonel Ludlow called the Main Ship Channel no longer adequate for the needs of the Port of New York. In his opinion, the Nation had a vital interest in maintaining the commerce of its leading entrepôt.

The District Engineer proposed building a great new sea lane into New York Harbor by an entirely new route. He suggested expanding the East Channel, a passageway which had depth of only 16 feet and had been used only by small light-draft vessels such as towboats and scows. Colonel Ludlow recommended making this a broad, deep and straight access route, 35 feet-deep and 2,000 feet wide. This would allow major ships to navigate the harbor entrance safely not only in daylight but at night and in heavy fog. The East or Ambrose Channel cut five miles off the Main Ship Channel route and avoided the latter's sharp turns and many cross currents. Furthermore, the tides in the East Channel would help maintain its depth naturally, thus reducing the cost. The project would involve removal of 29 million cubic yards of mud and sand and would cost $3.8 million. Colonel Ludlow's recommendation received the concurrence of the Division Engineer, a special board of Army Engineers, and the Chief of Engineers. These officers, however, suggested that the depth be increased ultimately to 40 feet. The cost would then be $6.7 million. Congress adopted the Corps' recommendations in 1899 and ordered work on the monumental job to begin.[17]

A race against time ensued. The Army Engineers had to prepare the harbor channel in time for the arrival of the giant new Cunard liners due to be completed in a half dozen years. Using private contractors and then their own specially-constructed seagoing hopper dredges, the Engineers not only completed the project in time but obtained a savings. The first of the new liners to enter the Ambrose Channel, the 32-foot draft *Lusitania*, crossed the bar on September 13, 1907. Only ten days had passed since the Corps had finished dredging the channel down to 35 feet and placed the last marker buoy in the channel. In succeeding years, the Corps lowered the depth to 40 feet. The Ambrose Channel was officially declared completed in 1914. The cost was $1.5 million below the 1899 estimate.[18]

In the early years of the 20th Century, New York Harbor kept its place as one of the busiest ports in the world in part because of the work of the Army Engineers. They provided the surveys and supervised the work which modernized the harbor waterways. In these years the Engineers also widened and deepened Buttermilk Channel, leading into the Brooklyn Naval Yard, and the Hudson River (the old North River) from Ellis Island to the Hoboken waterfront and to the piers along midtown Manhattan. They improved the Arthur Kill, Kill Van Kull and other routes behind Staten Island to help service the growth of industry in such new ports as Perth Amboy, Carteret and Elizabeth, New Jersey. Following the endorsement of the District and Division Engineers, Congress appropriated $5 million to provide a channel 12-feet-deep and 200-feet-wide in the upper Hudson River to accommodate commerce generated by the New York State Barge Canal.[19] The Engineers also deepened the channels in the harbors at Boston, Baltimore and Norfolk.

One of the most extensive dredging projects of the early years of the 20th Century involved the improvement of the Delaware River. The Engineers recommended expanding the channel there to a depth of 35 feet and a width of 1,000 feet for 63 miles from the sea upriver to Philadelphia. By 1920, the task was 56 per cent completed. Some 35 million cubic yards of mud and sand and 23,000 cubic yards of ledge rock had been removed. The Government had spent $11 million on the project, enabling the Delaware River to continue as one of the major commercial waterways of the United States.[20]

Whenever possible, the Corps contracted out the dredging projects. However, in many cases, the Army Engineers had to provide their own dredges and other floating plant. The Corps purchased its first dredge in the 1850s and its fleet had grown slowly thereafter. In the early 20th Century, its floating plant expanded more rapidly to keep pace with the increasing river and harbor work. In December 1917, the

Philadelphia District had 22 vessels, including scows, tugboats, gasoline launches, a drill boat and three dredges. The latter were the 886 ton hydraulic pipeline dredge *Cataract* and two 4,000-ton seagoing hopper dredges, the *Manhatten* and the *Delaware*. Norfolk District had 32 vessels, New York's 2d District had eight, and New York's 1st District had more than 50, ranging from rowboats and barges of all sizes to piledrivers, derrick boats and dredges.[21]

In addition to their other civil works duties, the Army Engineers continued their responsibilities in the Nation's capital. They supervised the maintenance of the White House, the Washington Monument and the Washington Aqueduct. Congress made the Corps also responsible for the care of nearly 500 parks and reservations in the District of Columbia including the 1,600-acre Rock Creek Park.[22] At least two new major projects were undertaken. Between 1915 and 1923, Army Engineers supervised the planning and construction of the Georgetown Bridge, the first highway bridge across the Potomac River. In 1912, the Corps initiated a major reclamation project on the Anacostia Flats, the marshland in the eastern part of the District. By 1922, they had excavated six million cubic yards of material from the Anacostia River channel and claimed more than 800 acres of land.[23]

IV

New Missions

Congress assigned a number of new missions and powers to the Corps of Engineers in the late 19th and early 20th Centuries. To help maintain the navigability of waterways, the Engineers received new regulatory authority. They were also directed to improve and maintain government-purchased canals. Also they did special duty in disaster relief and flood control work. In addition, the Corps participated in the debate over conservation and the involvement of the Federal Government in the management of the Nation's resources. Division Engineers played an important part in defining and carrying out these responsibilities.

During the first two decades of the 20th Century, a major debate emerged over the proper role of the Federal Government in developing and using the natural resources of the United States. Like the other efforts at modernization during the Progressive Era, the movement for a new water resource policy — one which aimed at multiple-purpose development of the Nation's waterways — created a clash of conflicting viewpoints about both means and ends. As the Corps of Engineers became one of the focal points of the controversy, Division Engineers provided valuable advice on the issues to their subordinates and to the Chief of Engineers. By 1908, a growing number of progressive reformers advocated multipurpose river development, including irrigation, navigational improvement, water storage, flood control and hydroelectric power generation through the construction of dams. This multipurpose river development also won support from another popular movement. This movement urged that the Federal Government do more to promote inland waterways throughout the Nation as alternatives to railroad transportation.[24]

On the whole, the Army Engineers reacted skeptically toward these latter proposals for extensive Federal waterway programs. They did not think many of these projects served the larger National interest and doubted whether they were worthy of Federal funding. Colonel Abbot, then in retirement, advised the Chief of Engineers that unlike the great seaports, many rivers and canals, which were of transcendent importance as major entrepôts and highways, served purely local business and had little practical value.[25] Supporting this view, the Board of Engineers for Rivers and Harbors, during the first two decades of its existence, recommended against nearly 70 per cent of new waterway projects it surveyed for Congress.[26]

Army Engineers also disagreed with suggestions for multiple-purpose management of water resources by the Federal Government. They challenged many of the arguments and proposals of the reformers. The engineering profession as a whole divided over issues such as the relationship of forest cover to stream flow and flooding, and the possibility of building economical dam and reservoir systems which would not substantially interfere with river navigation.[27] The Corps' primary objection was that navigation — not

The Famous Johnstown Flood. Disaster relief assignments were given to the Corps of Engineers beginning with the Johnstown, Pennsylvania flood of 1889. Heavy rains on the night of May 31, 1889 put increasing pressure on an abandoned dam which had been constructed decades previously by the Pennsylvania Canal Company for a viaduct. In the middle of the night, the dam burst, sending its torrents of water surging through the small town below. More than 2,000 persons died. Artist W.A. Rogers made the dramatic re-creation shown here for Harper's Wheekly *magazine. Company A of the Engineers was sent from Willet's Point in New York to provide flood relief and restore roads, bridges, and eventually the dam itself.*

other subsidiary uses — was the Federal Government's main Constitutional concern with waterways. They noted that the Supreme Court ruling in Gibbons *v.* Ogden, which had recognized Federal Government supremacy over state and private interests in regard to stream navigation, had been based upon the interstate commerce clause. It might not apply to other uses of the waterways.[28]

As precursors of future developments, a few Army Engineers asserted that the Federal Government should assume responsibility for hydroelectric power projects. Otherwise, the growing number of private dams might jeopardize navigation by obstructing or lowering the stream flow. As early as 1911, Colonel William M. Black, Northeast Division Engineer and later Chief of Engineers, advised his superiors that the U.S. Government should exercise such authority to protect the interests of the Nation as a whole when they conflicted with those of the local community.[29]

New authority came to the Army Engineers in the late 19th and early 20th Centuries. In a series of laws between 1886 and 1920, Congress gave the Corps substantial regulatory powers to prevent obstructions to navigation in America's waterways. The lawmakers had become concerned about the effects of the tremendous growth of commerce and the rapid expansion of activity in the Nation's ports. In 1886, they empowered the Engineers to establish harbor lines and to regulate the dumping of debris and the construction of piers and wharves inside these lines. Within two years, Division Engineers received appointments as presidents of boards to establish regulations and preserve the major harbors of the country.[30]

One of the potentially most important pieces of legislation in these years was the Refuse Act of 1899. Section 13 of that act, commonly known as the River and Harbor Act of 1899, forbade dumping into navigable waterways without a permit obtained from the District Engineer. Other sections of the act required permits from the District Engineer for construction of wharves, piers, bridges and bulkheads. Expanding enforcement powers as well, Congress, in Section 17 of the Refuse Act, gave the Corps authority to arrest violators.

Despite the broad powers implied in the Refuse Act, the legislation operated for years only to protect navigation, not as a device to control pollution. The Army Engineers did not establish this early limited interpretation. Instead, the Engineers sought to extend it to pollution control since the legislation outlawed the casting of "any refuse matter of any kind or description" into the waterways. In 1910, Colonel Black, then the Northeast Division Engineer, supported a group of New Yorkers in an effort to invoke the act against a proposed sewer emptying into the harbor. However, the Army's Judge Advocate General, supported by the U.S. Attorney General, held pollution control a function of the states alone, not the Federal Government. Curbed by such a limited legal interpretation, the Refuse Act was not applied to pollution control until the 1960s.[31]

Around the turn of the century, Congress also gave the Corps authority to regulate construction which would affect any port of navigable rivers. Section 10 of the River and Harbor Act of 1899 forbade any change in the "course, location, condition, or capacity" of waterways by any obstruction not approved by the Federal Government. To implement this legislation, the Corps established a nationwide permit program under which District Engineers processed applications from those who wanted to make any changes in navigable waterways. Supervised by Division Engineers, they issued permits, inspected the work, and reprimanded and occasionally arrested offenders.[32]

The following example of the praise given to Army Engineers for the use of their regulatory power to protect the public interest in maintaining navigability in New York Harbor was printed in a 1903 edition of *Scientific American.*

> Had it not been for the professional fidelity with which our military officers have performed their duties, incalculable injury would have been wrought to the shipping interests of this country both inland, river and deepsea, by the obstruction of waterways and by destructive encroachments upon the deepwater area of our harbors.[33]

The Federal Government acquired some new canals in the early 20th Century and directed the Corps of Engineers to construct or modernize them. The most famous, the Panama Canal, was built between 1906 and 1914 under the primary supervision of Colonel George Washington Goethals, who had been the Newport, R.I. District Engineer between 1900 and 1903. On the Atlantic Coast, Congress sought to connect the great inland bays. It purchased several privately-owned canals there. In 1919, for example, the United States took over the Chesapeake and Delaware Canal which had been constructed in the 1820s. Because of its shallow draft, narrow locks and twisting course, the canal had failed to accommodate large, modern naval and merchant ships. Consequently, it had fallen into disuse. Following government purchase, the Army Engineers surveyed the canal. In 1920 they recommended that the locks be eliminated and that it be converted to a sea-level waterway, widened to 90 feet and deepened to 12 feet. As such it could serve as a supplementary route for commercial and smaller naval vessels between New York and Philadelphia in the North and Baltimore and Norfolk in the South. Conversion and modernization began in 1921.[34]

Another new mission assigned to the Corps in these years was relief work during natural disasters. The famous flood in Johnstown, Pennsylvania, became the first of these assignments. During heavy rains in 1889, an abandoned canal company dam burst. Rushing waters demolished the small city, killing more than 2,000 persons and leaving thousands homeless. Hastening from Willetts Point, Company A of the Army Engineers arrived soon afterwards. The Engineers provided flood relief, restored roads, bridges, and rebuilt the dam. The Federal Government also sent out Engineer troops in response to the great Baltimore fire of 1904 and the San Francisco earthquake and fire of 1906. Engineers dynamited buildings to check the spread of the fire; they also helped to provide housing for the homeless. During the disastrous floods in the Ohio and Mississippi River Valleys in the spring of 1912 and 1913, boats from the Corps performed essential rescue work. The Army Engineers' activity in disaster relief and flood control in these years proved a harbinger of things to come. Within a few decades, both would become regular functions of the Corps of Engineers.[35]

V
Military Construction and Engineering

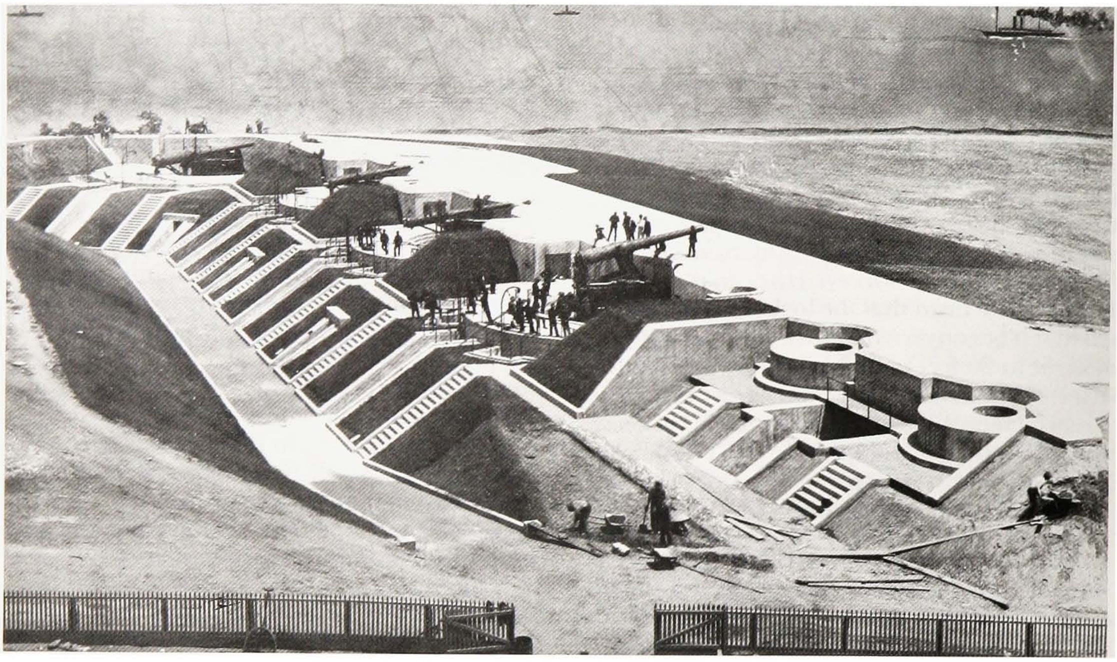
Economic growth and technological change at the turn of the century also affected the military construction and engineering work of the Army Engineers in the North Atlantic Region. In the Spanish-American War, the Philippine Insurrection, and in World War I, the Corps modernized seacoast fortifications and assisted field commands. Once again, the Army Engineers proved themselves a valuable instrument of National defense.

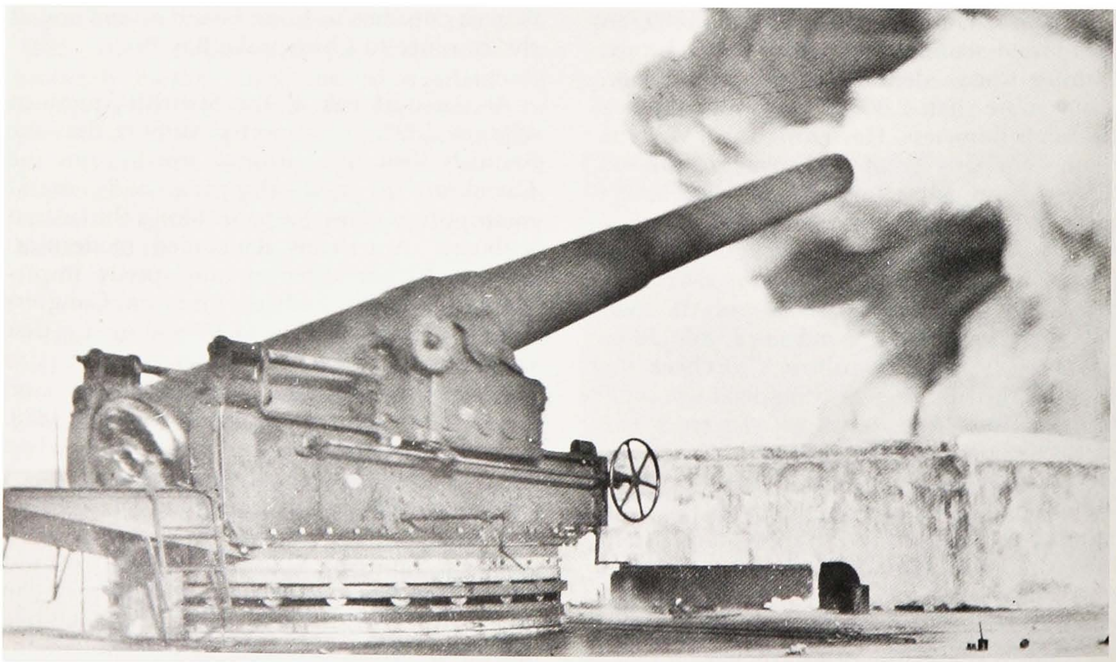
The Nation needed new fortifications because of developments in warships. Major industrial countries began to build modern, armor-plated steel battleships and cruisers fitted with breech-loading, rifled guns and new propellants which increased muzzle velocities and range. Consequently, two study commissions recommended improvement of America's coastal defenses. In 1886, a board headed by Secretary of War William C. Endicott called for a massive new fortification program. It gave top priority to the ports of the New England and Middle Atlantic states. Twenty years later, a board headed by Secretary of War William Howard Taft recommended additional gun sites in the territories taken during the Spanish-American War as well as sites at the eastern entrance to Long Island Sound and at the entrance to Chesapeake Bay.[36]

At the outbreak of the Spanish-American War in 1898, unsupported rumors that the Spanish fleet had steamed north from the Caribbean to raid shipping and coastal metropolises caused a panic along the eastern seaboard. Americans demanded modernization of harbor defenses and speedy implementation of the Endicott program. Congress alloted over $9 million in 1898 alone for that purpose and directed the Army Engineers to expedite construction through double and even triple shifts. By the end of 1898, construction had begun or been completed on nearly one-third of the seacoast defenses envisioned by the Endicott plan.[37]

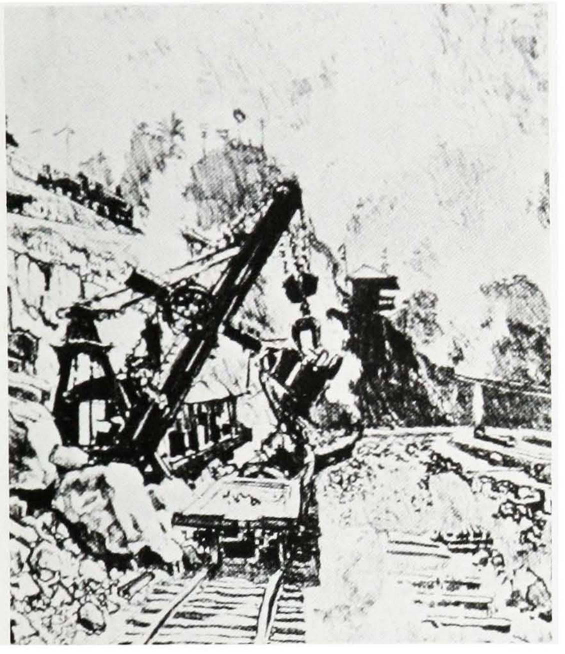
When the Army Engineers completed most of the Endicott-Taft seacoast defense system just before World War I, the United States had the most formidable coastal defenses in the

world. Earthen and concrete emplacements housed nearly 700 new, high-powered, long-range guns to protect 25 principal harbors in the country and its territories. The Corps spent $6 million acquiring sites and $32 million constructing the emplacements. Guns mounted in disappearing-type carriage below ground level could be raised for firing. Almost invisible from the sea, the dispersed, low-level emplacements blended into the surrounding landscape. Their massive frontal walls contained up to 20 feet of reinforced concrete behind 30 feet of earth facing and made them invulnerable to direct fire from seaward. The new batteries contained 8-, 10-, and 12-inch breech-loading rifles. At 30-second intervals,





they could hurl a 1,700-pound projectile at effective ranges up to eight miles. Because of their greater range and the spread of seacoast cities, these guns, in batteries of two to four weapons each, were generally situated much closer to the sea than the old high-walled fortresses of the early 19th Century. Many of these massive earth and concrete emplacements, their guns taken away for salvage and other purposes, remain standing today at the seaward entrances to the great bays and harbors of the coast.[38]



Top Left. Artist's Sketch of Coastal Defense, Featuring 10-Inch Rifle on Disappearing Carriage,1890s, at Fort Armistead, Maryland.
Source: The National Archives, Washington, DC.

Bottom Left. A 10-Inch Lift Gun Used for Long-Range Defense, Fort Hancock, New Jersey.
Source: The National Archives, Washington, DC.

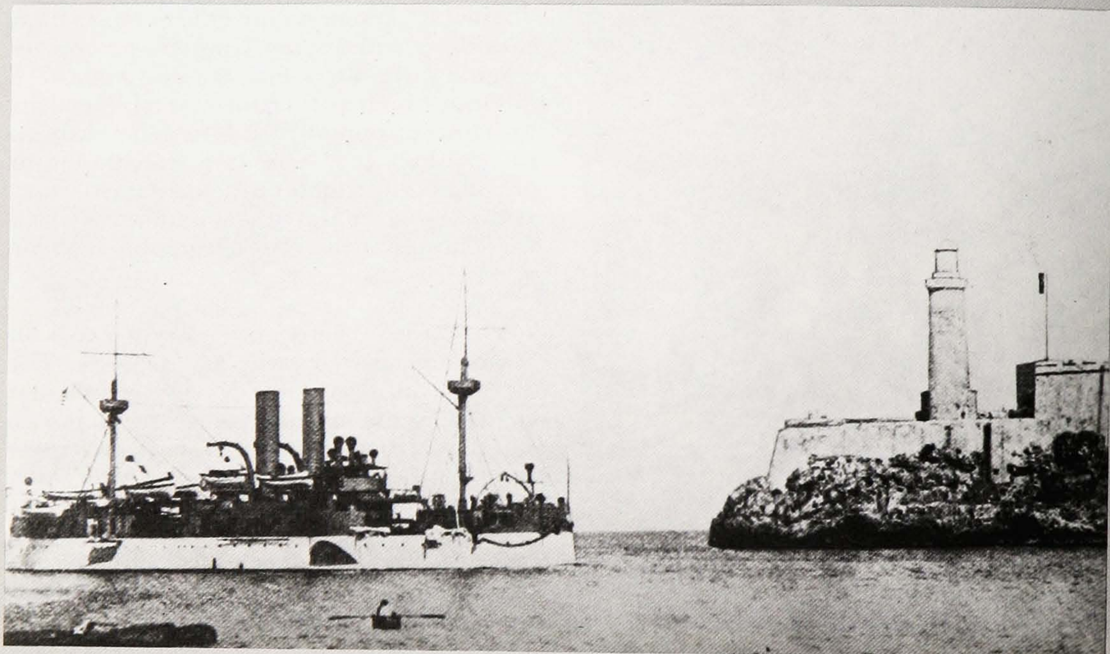
Above. Building the Panama Canal. One of the greatest engineering feats of the early 20th Century was the construction of the Panama Canal between 1906 and 1914. President Theodore Roosevelt assigned supervision of the project to the Army engineers. In charge was George Washington Goethals, who between 1900 and 1903 had been Engineer of the Newport, R.I. Engineer District in the jurisdictional area of the Northeast Division. In 1912, lithographer Joseph Pennell immortalized the men who built the Canal and the efficient system of handling and transporting the excavated material they developed.

The Corps of Engineers also installed a variety of harbor protection devices at the turn of the Century. They created underwater mine systems to replace chain barriers. Stored ashore, the mines could be rapidly strung across a harbor by special mine-laying ships. In order to prevent enemy minesweepers from clearing these fields, the Army set up a number of rapid-firing 3-to 6-inch guns on shore. The Engineers built plain concrete emplacements with low surrounding parapets to house them. In addition, they mounted searchlights to provide illumination of the harbor entrances at night and improved communications and fire control systems using telegraph, telephone and wireless devices.[39]

The extensive harbor defense system took on a new role in the early 20th Century. The maritime mission of the Navy changed from coastal defense to command of the high seas. As the Nation adopted a more offensive strategy, the primary function of the coastal defenses shifted from protection of the population centers to provision of security for Navy bases and repair facilities. By the Second World War, the needs of the fleet had become the primary reason for fortifications.[40]

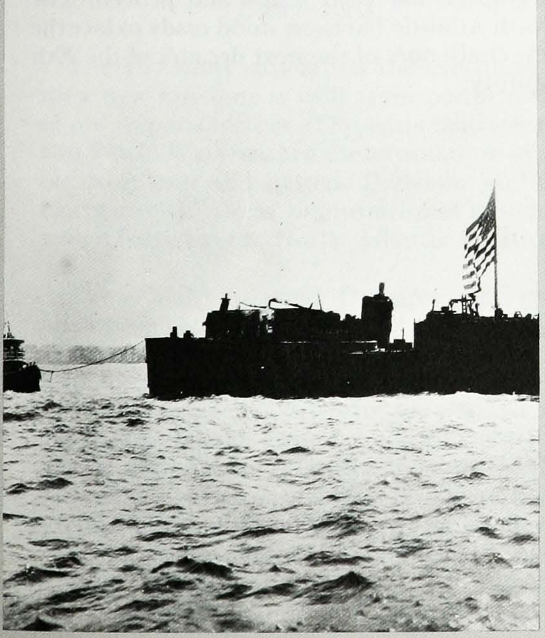
Because it involved the most extensive mobilization of men and machines up to that time, World War I made expeditionary demands upon the Army Engineers. However, the Corps' greatest activity during 1917 and 1918 occurred outside the United States. The Corps received responsibility for military engineering and construction work with the American Expenditionary Force (A.E.F.) in France. There it prepared facilities to receive, transport, supply and maintain the hundreds of thousands of "doughboys" who began to arrive early in 1918. Most military construction in the United States was assigned to the Construction Division of the Quartermaster General's Department. However, Army Engineers did build the first complete system of American embarkation points for storing and shipping engineer supplies for the A.E.F. They erected these embarkation facilities in the ports of New York, Philadelphia, Baltimore, and Norfolk. Because of the shortage of

The Raising of the Maine (1911-1912). One of the incidents which led to the Spanish-American War in 1898 was the destruction of the U.S. battleship Maine *which blew up in Havana Harbor with the loss of 260 American lives. The American public blamed the explosion on the Spanish, although it now seems unlikely that the Spanish government would have sanctioned an act which encouraged American intervention in the conflict between Spanish troops and Cuban revolutionaries. The wreckage of the* Maine *lay in 35 feet of water in the harbor for more than a decade until the U.S. Government decided to remove and dispose of the obstacle to navigation. Officials also hoped to determine whether the explosion which sank the ship had been caused by spontaneous combustion due to the deterioration of the smokeless powder in her magazine,*



as had been the case in the explosion of the French battleship Jena, *or by an external mine as a Naval Board of Inquiry had concluded in 1898. The finding was inconclusive. The Government also wanted to provide a proper burial for the bodies of 75 Americans entrapped in the wreckage.*

Source: The National Archives, Washington, DC.



available officers during the war, Brigadier Generals William T. Rossell and Theodore A. Bingham came out of retirement to head the Northeast and Eastern Divisions.[41]

Following the war, the Army Engineer School, which had been moved from Willet's Point, New York, to the Washington Barracks in the District of Columbia in 1902, was given expanded new quarters. In December 1918, the Engineer School moved to Camp Humphreys, Virginia, which is now known as Fort Belvoir.[42]

The task of raising the shattered hulk of the *U.S.S. Maine* from the bottom of Havana Harbor was assigned to the Corps of Engineers. But uncovering and removing the *Maine*, a modern warship 324 feet long and displacing 6,700 tons, was arduous because the Navy wanted to examine the wreckage where it lay before removing and disposing of it.

Colonel William Black, the Northeast Division Engineer, headed a Board of Engineers appointed to supervise this assignment. To accomplish his mission, Colonel Black decided to build a cofferdam around the wreckage. This watertight temporary structure was similar to those in building the foundations to bridges and dams. In this case, it had to encircle the wreckage in an area 350 by 170 feet. As the water level inside the cofferdam was lowered to 35 feet to expose the wreckage, the 20 component cylinders of interlocking steel piling had to withstand water pressure of up to 15,000 pounds per square foot. Furthermore, pilings had to be driven down 50 feet in order to reach clay stiff enough to maintain stability of the pilings.

The operation last nearly a year and a half. The ship had been practically blown in half and it proved impossible to determine conclusively whether the explosion had been internal or external. The bodies were removed and taken to Arlington National Cemetery for burial.

In the spring of 1912, the Maine made her last voyage. The water was let back into the cofferdam and on March 15, the stern half of the wreck was floated. U.S. Navy tugs towed the hulk to sea. Colonel Black recorded the historic moment in his diary.

> The tugs started towing the Maine. . . . followed by the North Carolina, Birmingham and some Cuban naval vessels, followed by the dredge Barnas and a number of other craft. Almost 80 craft in all attended. The nine mile limit was signalled from [the lead ship]. The lines were cast off from the Maine. After the other vessels had assembled, the signal for scuttling the ship was given at 4:41 p.m. when Harper and party which had boarded the Maine opened, first, the interior bulkhead doors, second, ports in the temporary athwartship bulkhead, and then two 6″ sea cocks in the ship. At 5:21 p.m. the Maine disappeared in 620 fathoms of water.

Secretary of War Henry Stimson called it "a monumental work, and one without precedent."

VI

Conclusion

The decades which straddled the turn of the century represented a time of modernization for the country and the Corps of Engineers. The Nation became transformed from a primarily rural, agricultural land to an urban, industrial world power. Its institutions — economic, social, political, military and others — adjusted in order to function effectively in the new environment. Those who encouraged the change emphasized the need for rationalization, reorganization, hierarchical administration, and the establishment of new forms of operation and control to maintain order and direction in a rapidly shifting world. Large-scale, often national, units emerged in business, labor, the professions and other groups as centripetal forces of industrialism pried loose local community ties. A land of scattered and relatively isolated communities was being welded by the bonds of technology and nationalism into a larger entity, a Nation.

Like many other organizations at the time, the Corps of Engineers adapted successfully to these changes. This meant new organization and new missions. Modernization in the Corps led to the establishment of a three-tiered administrative structure. In this, Divisions, like those in the North Atlantic Region, played an important role in the process of coordinating national, regional, and local needs. Established in 1888, the Divisions found their supervisory functions evolving with changing times. Over the succeeding years they built up a series of precedents and traditions. The Divisions proved they could be a benefit to both the Corps and to the region they served. Traditional missions of the Army Engineers were expanded and new tasks added to meet the growing needs of an industrializing Nation. By the end of World War I, the modern organizational structure of the Corps of Engineers had been tested and proven. The North Atlantic Division stood ready to face the new challenges of the next decades of the 20th Century.

CHAPTER 3

New Responsibilities: Flood Control and Other Missions, 1920-1940

I

Introduction

In the 20 years between the two World Wars, the Corps of Engineers moved beyond being an organization almost exclusively concerned in its civil works role with navigation improvements. It became involved in a major way with multi-purpose utilization and improvement of the Nation's waterways.

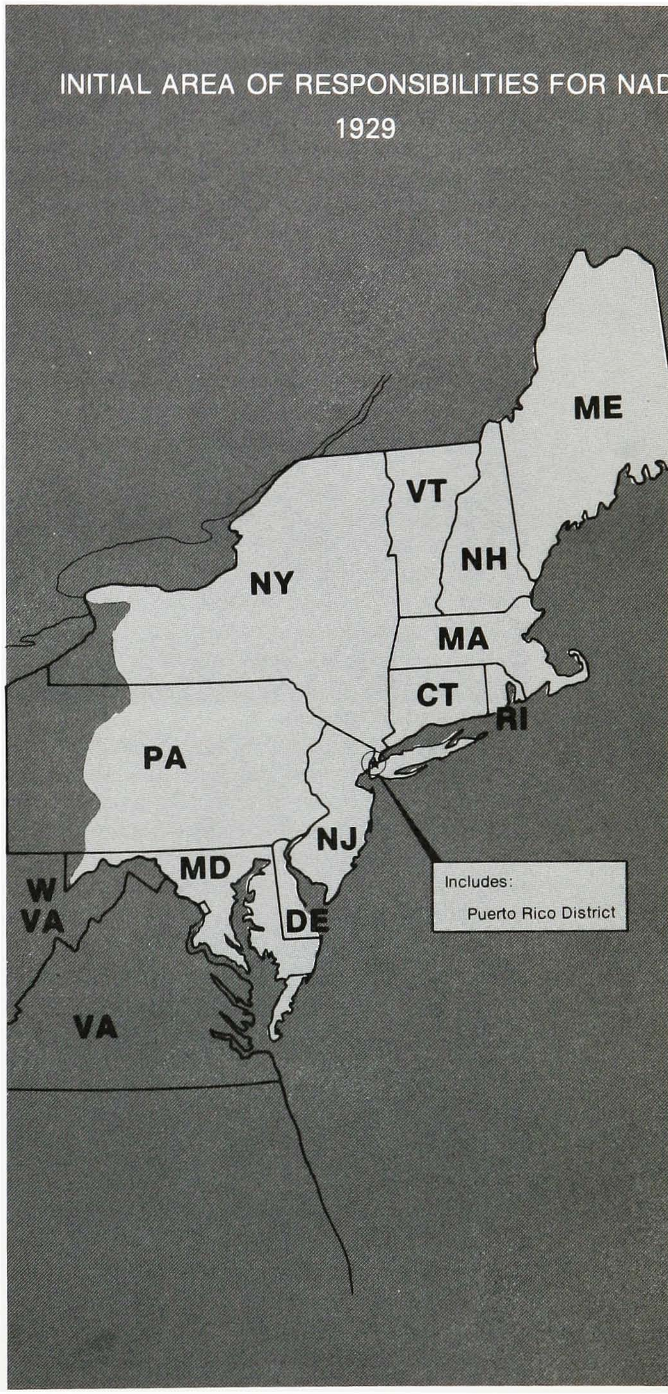
The Federal Government grew more concerned in these years with large-scale planning, conservation of the Nation's resources, and protection against disaster. As a result, Congress directed the Army Engineers to take on the new functions of beach erosion control in 1930 and flood control in 1936. These proved precursors of a host of new missions in the area of coastal plain and river basin planning and development.

II

Establishment of North Atlantic Division

The Divisions supervised the execution of these new missions as well as the performance of old responsibilities. The years between the two World Wars marked the termination of the old Northeast and Eastern Divisions and the emergence of a new organizational structure which included the North Atlantic Division.

The North Atlantic Division was established on October 7, 1929. It stemmed from a general reorganization in which the Chief of Engineers reduced the number of Divisions in the Corps from ten to eight. He merged the Northeast and the Eastern Divisions together into a new North Atlantic Division (NAD). From its headquarters in New York City, NAD oversaw Army Engineer responsibility in the rivers, harbors, and canals along the North Atlantic Coast.



Initially, NAD's area of responsibility ran from Maine to Delaware. It included eight Districts: Boston, Providence, the 1st, 2nd and 3rd New York Districts, Philadelphia, Wilmington, Delaware and Puerto Rico. A number of changes in the jurisdiction of the North Atlantic Division took place in the decade after it was founded. The Chief of Engineers discontinued some Districts like the 2nd and 3rd New York and the Wilmington Districts. He transferred others, like the Baltimore and Washington Districts, to NAD from the South Atlantic Division, and he created some new Districts, like the one in Binghamton, New York, later redesignated the Syracuse District, in order to assist with the new flood control responsibilities.[1]

III

Flood Control and the Expansion of the North Atlantic Division

When it adopted nationwide flood control in 1936, Congress based the program upon a series of studies done by the Army Engineers over the preceding 20 years. Spurred by severe floods in the Sacramento and Mississippi River Valleys in 1917 and 1927, Congress directed the Corps to undertake these studies. They focused on flood control on the Nation's major rivers as well as estimates of the costs of improvements to navigation, hydroelectric power and irrigation.

In the 1920's and early 1930's, the Army Engineers surveyed practically every major river basin in the country and recommended plans for multi-purpose improvement of these waterways. Following a mandate in the River and Harbor Act of 1925, Congress printed preliminary examinations and estimates in 1926 as House Document No. 308. Consequently, the surveys came to be known as the "308 Reports." In these, the Engineers recommended that some 2,000 flood control and other projects be built over the next half century. The cost would be approximately $8 billion. The "308 Reports," prepared by the President's Committee on Water Flow, formed the documentary basis for the comprehensive water resources program which the Roosevelt Administration submitted to Congress in 1934.[2]

The National Plan included several regional studies. Colonel George Hoffman,

Top Left. Map Shows the Main Flood Areas: New England, the Middle Atlantic Region, and the Middle West. Heavy rains in the upper part of the country eventually made the Lower Mississippi (cross-marked) overflow its banks.
Source: The National Archives, Washington, DC.

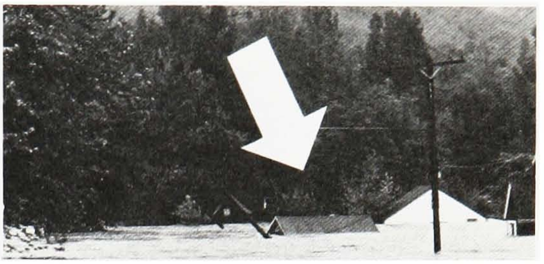
Bottom Left. The Merrimack River Inundated Manchester, New Hampshire, during 1936 Flood.
Source: The National Archives, Washington, DC.

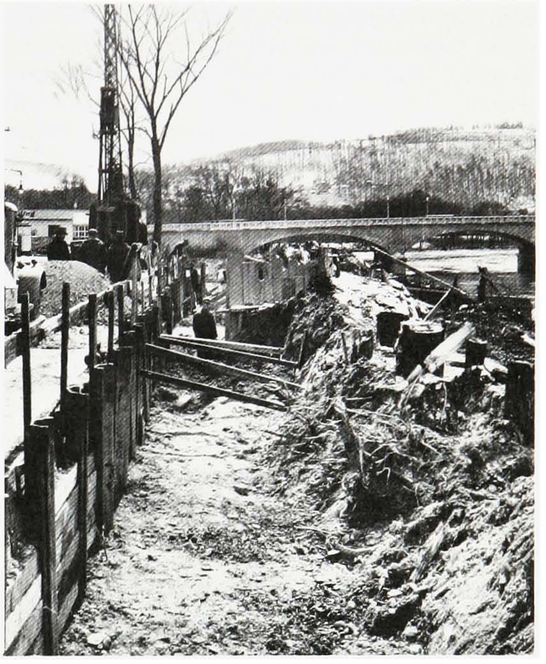
Top Right. Garage Floating Down the Street in Elmira, New York, during 1936 Flood.
Source: The National Archives, Washington, DC.

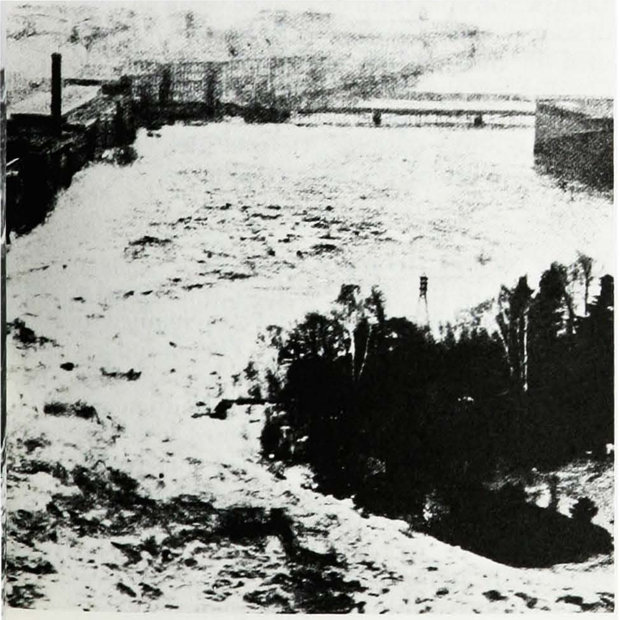
Center Right. Retaining Walls Under Construction at Binghamton, New York, 1942.
Source: The National Archives, Washington, DC.

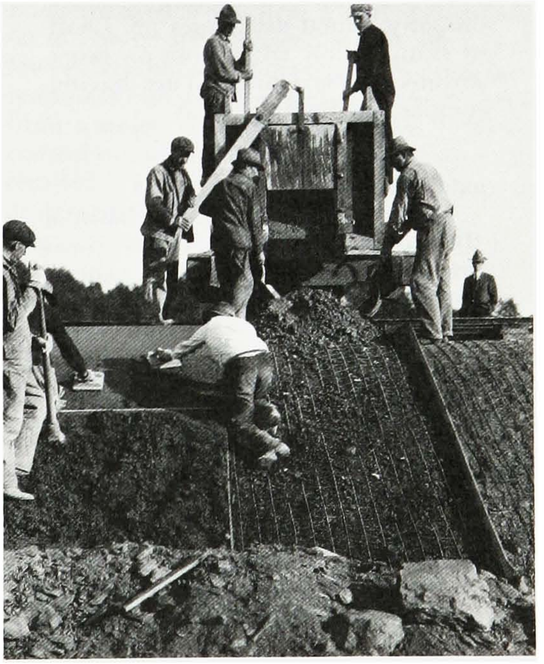
Bottom Right. Workmen Placing Concrete Paving on a Flood Control Dike in 1942.
Source: The National Archives, Washington, D.C.


WISCONSIN
MICHIGAN
NEW YORK
MAINE
VT
NH
MASS
RI
CONN
PENNSYLVANIA
NJ
MD
DEL
ILLINOIS
INDIANA
OHIO
WEST VIRGINIA
VIRGINIA
SOURI
KENTUCKY
NORTH CAROLINA
TENNESSEE
KANSAS
SOUTH CAROLINA
MISSISSIPPI
ALABAMA
GEORGIA
ATLANTIC OCEAN
OUISIANA
FLORIDA
GULF OF MEXICO









the North Atlantic Division Engineer, served as a member of the Atlantic Region Subcommittee of the President's Committee. In regard to the rivers of the North Atlantic Region, Colonel Hoffman and the other committee members noted that the streams there rose in the Appalachian Mountains, crossed the Piedmont Plateau and the Coastal Plain and emptied into the Atlantic Ocean. Therefore, navigation and flood control became most important in the Coastal Plain, water power and soil erosion in the Piedmont Plateau, and reforestation in the mountain regions. In the past, the Federal Government had aided navigation projects in the major rivers of the Coastal Plain. But flood control in the region had for generations been largely a matter of local concern. Although the report warned that it would be impossible to prevent flooding entirely, it asserted that damage could be reduced through dams, levees, and elimination or modification of housing and commercial construction on floodways.[3]

Colonel Hoffman and the others gave the following report about potential flooding on the major rivers of the Atlantic Region:

> Delaware River: There is no record of any flood on the Delaware River which attained the magnitude of a disaster or caused great loss of life or property. Flood discharges are small in comparision with those on other streams in the United States having comparable drainage areas.

> Susquehanna River: In the basin of the Susquehanna River Valley towns and low-lying properties in general are subject to overflow.

> Potomac River: The Potomac watershed lies in a region of comparatively high rainfall and on two of the paths commonly followed by great cyclonic storms. Much of this area is mountainous or hilly with steep slopes and thin soil, conditions which are favorable to rapid concentration of run-off. As a result, floods are frequent.

> Connecticut River: Floods are a serious problem in the Connecticut Basin. Major floods cause serious damages to private and public improvements, dislocate traffic, and sometime cause loss of life.

> James River: The James Basin is subject to periodic floods.

> Hudson River: Of the tributaries, the Hoosic River rises in Massachusetts and flows westerly into the Hudson. Several towns are subject to frequent flood damage.

Congress took the report under consideration, but before a year had passed, nature and public pressure forced the lawmakers to give serious attention to the problem of flood control.

Like a recurring plague, heavy rains came summer after summer in the years between 1934 and 1936. Flooding on the Raritan River in New Jersey in 1934 proved but an omen of more devastation. In mid-summer 1935, torrential rains sent terror-producing floods across a ten-county area of south-central New York State. Highways, railroads, bridges, and dwellings crumbled under the surging waters. Destruction and death descended upon an area of some 7,000 square miles. At least 57 persons died in the swirling wreckage. Some 3,000 families lost their homes. The most destructive floods in the Empire State since 1865 caused $30 million in damage. Despite the devastation, there was still more to come.[4]

The deluge returned with even greater vengeance in the spring of 1936. It followed a severe winter. Much snow and ice remained in the Northeast in early March. Then a sudden spring thaw turned ice and snow to water. On March 10, steady, soaking rainfall drenched the region. Water slid off saturated hillsides. Rivulets grew into creeks, creeks into rivers, and rivers into torrents churning across most of the states from Maine to Virginia. The floods came in deadly quiet. Silently, relentlessly, in the dark of night, the rivers rose and overflowed into the flood plains.

Despite the rescue work, 171 persons died. Another 430,000 found themselves without homes. Property damage soared to $500 million. In the Connecticut River Valley, people called it the worst major disaster in memory. The swollen rivers washed out Connecticut's tobacco crop, burst through sandbags and gushed into the streets of river cities in the region. Hartford, Connecticut, and Pittsburgh, Pennsylvania, were the worst hit. The industrial life of the region slopped to a halt. Rambunctious rivers roared out of control — the Susquehanna, Monongahela, Penobscot, Housatonic, Allegheny, Conemaugh and a score of others. Only a 19-foot sandbag barricade thrown up by 3,000 workers saved Washington, D.C., from being engulfed by the surging Potomac.[5]

As a result of the disasters in the Northeast, as well as similar floods in the Mississippi and Ohio River Valleys, Congress passed the Flood Control Act of 1936. The law marked a revolutionary step in flood control legislation. Replacing the previous practice of enacting separate bills for each river system, the new law provided for a comprehensive national program of flood protection. It included dikes, levees, dams and retention reservoirs.

The Corps of Engineers received responsibility for supervision of the Federal flood control construction. Initially, Congress authorized about 270 projects costing some $310 million. In each, the Federal Government required states and municipalities to pay local costs in return for Federal flood control works.[6]

Within the North Atlantic Division area, the Engineers initiated a number of flood control projects in the late 1930's. In New York and Pennsylvania, Congress appropriated $27.5 million for such projects. In addition, President Roosevelt allocated $3.5 million for special emergency relief labor to aid the stricken areas immediately. Within a year, the Army Engineers had surveyed subsurface, design, and hydrological conditions, contracted for employment of the Depression jobless, and begun construction. They built levees, concrete flood walls, and pumping stations on the Susquehanna River throughout the Wyoming Valley of Pennsylvania. At the same time, they constructed the earth and rockfill Indian Rock Dam on a tributary of the Susquehanna to prevent the flooding of the Town of York by the river.

In southcentral New York, the Flood Control Act provided for 13 local protection projects and seven dams and reservoirs. The first of these dams to be completed, the Arkport Reservoir of the Canisteo River near Hornell, began operation by 1939. By 1943, Congress authorized $46 million for flood protection in the Connecticut River Valley in New England. This included some 20 dams and retaining reservoirs on tributaries in Vermont and New Hampshire. Some of these projects in the NAD area were completed by 1942, but a number were suspended during World War II and remained unfinished until the late 1940's or early 1950's.

Adoption of the flood control mission converted the size and nature of the North Atlantic Division headquarters. From a small operation conducted by less than half a dozen persons, it changed almost overnight into a larger, more emergency-oriented and higher-budgeted agency requiring a staff of more than 60 to handle its expanded workload. A staff lawyer who witnessed the transformation later reminisced about what he called the "... shift from a quiet, routine organization." "Flood control put us in the big time, moneywise," he recalled. "The public came to know about us as never before."[7]

NAD outgrew its old offices in the Army Building at 39 Whitehall Street in Manhattan in the 1930s and moved several times as it expanded. In October 1935, the Division relocated in the Maritime Exchange Building at 80 Broad Street. After the passage of the Flood Control Act, it acquired an additional 2,500 square feet in the Maritime Building. By November 1938, NAD leased 8,666 square feet there and awaited new quarters in the Federal Office Building under construction at 90 Church Street.[8]

Colonel Ernest D. Peek
Division Engineer, North Atlantic Division, 1936-1937.

Biographical Sketch

Major General Ernest D. Peek

Division Engineer, 1936-37

The man who led the North Atlantic Division during the transition to its new duties and importance under the Flood Control Act was Colonel Ernest D. Peek, Division Engineer from 1936 to 1937. A native of Oshkosh, Wisconsin, General Peek was graduated from the U.S. Military Academy, fourth in the Class of 1901. Through his career, the tall, brilliant officer rose rapidly, demonstrating ability in civil works and military engineering. As a young lieutenant, he attended the Engineer School at Willet's Point and then began his career by combat service against the Moros in the Philippine Islands between 1901 and 1904.

Returning to the United States, General Peek studied and worked on a variety of assignments with the Corps of Engineers. He supervised construction of locks and dams on the Kentucky River. He oversaw the improvement and repair of roads and bridges in Yellowstone Park. For three years, he studied at the Army Staff School at Fort Leavenworth. Resuming his river and harbor duty in 1912, he supervised construction of the lock and dam across the Mississippi River between the twin cities of Minneapolis and St. Paul. Consequently, he became assistant in charge of the River and Harbor Section of the Office of the Chief of Engineers.

During World War I, General Peek rose in responsibility and command. He led the 21st Engineer Regiment in the St. Mihiel and Meuse Argonne offensives. Later he took charge of highways and railroads in the combat zone of the First Army and subsequently became the Chief Engineer of the First Army. By the time of the Armistice, he had been appointed Deputy Director General of Transportation for the American Expeditionary Force. Upon his return to this country, General Peek taught at the Army War College. For four years, he supervised procurement of all Army supplies in the Office of the Assistant Secretary of War.

In the years of civil works expansion during the 1930's, General Peek spent nearly a decade

working for the Corps in the Northeast. In 1929, he supervised river and harbor work in New York City for several months. Then from 1930 to 1934, he served as Corps Area Inspector at Governors Island. For the next two years, he oversaw river and harbor work in Norfolk. At the same time, he served as consulting engineer for the Works Progress Administration in New York and all of New England. His exceptional efficiency in river and harbor work was recognized when he was assigned as the North Atlantic Division Engineer from 1936 to 1937.

General Peek began his Army career as an officer on troop duty and he ended it in the same manner. In July 1937, he was promoted to Brigadier General of the Line and placed in command of both the 4th Infantry Brigade and Fort Warren, Wyoming, then one of the Army's largest posts. Three years later, he received an assignment to San Francisco as Chief of Staff of the old Ninth Corps, which encompassed much of the West Coast. In 1940, Peek was promoted to Major General and named Commanding General of the Ninth Corps, the last person to hold that position before it was eliminated in the prewar reorganization. He retained command until October 1941 when, due to failing health, he was assigned to less strenuous duty at the Presidio of San Francisco. He retired from the service in October 1942, receiving a personal commendation from General George Marshall, Chief of Staff of the Army. General Peek lived in retirement in San Francisco until his death at the age of 71.[9]

In evaluating the recommendations of District Engineers, Division Engineers like Peek employed cost-benefit analysis as one of their major devices for measuring the worthiness of a particular proposed improvement. The Corps of Engineers had used cost-benefit analysis informally for a long time. However, in the Flood Control Act of 1936, Congress formally adopted the technique as a means of determining feasibility and thus gave it specific statutory sanction. Section I of the Flood Control Act stated:

> The Federal Government should improve or participate in the improvement of navigable waters or their tributaries, including watersheds thereof, for flood control purposes if the benefits to whosoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected.[10]

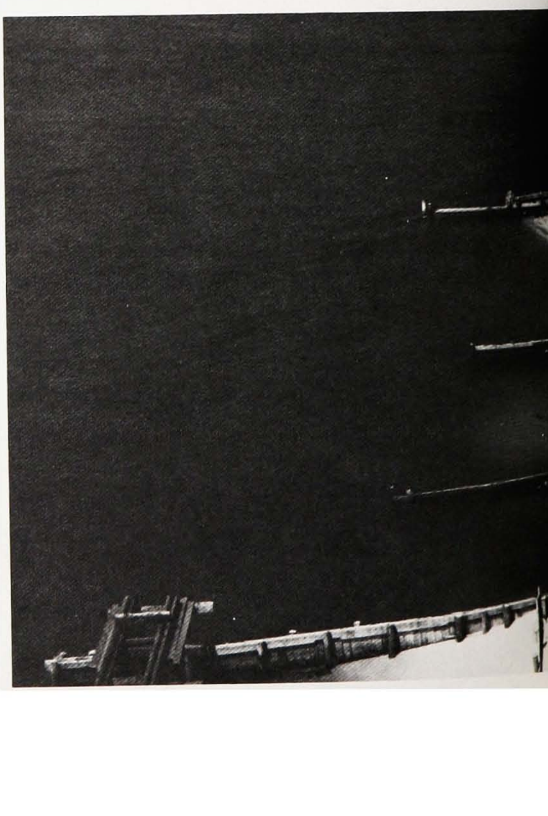
The massive flood control program proposed for the Connecticut River Valley provides an illustration of the value, as well as some of the complexities, of applying cost-benefit analysis to flood control. The Providence District Engineer surveyed the needs of the basin and in 1937 recommended a comprehensive program of flood control.

The 1936 Act had authorized 10 dams and retention reservoirs. In his report, the District Engineer suggested 20 upstream dams as well as seven dike projects along the river cities downstream. The North Atlantic Division Engineer agreed on the need for extensive flood control measures in light of the $34 million damages to the Valley caused by the 1936 flood. Furthermore, he concurred with his subordinate that 20 reservoirs were "necessary parts of an adequate, balanced regional plan of flood control and that the adoption of this system at the present time as a project for Federal Government participation is warranted by the excess of benefits over costs, the protection of life, and the maintenance of the social security of the people of the valleys."[11]

In regard to the number of dikes, however, the Division Engineer differed with his District

Top Left. Jetty Construction at Barnegat Inlet, New Jersey, Showing 20-Ton Boulder Being Put In Place, 1938.
Source: The National Archives, Washington, DC.

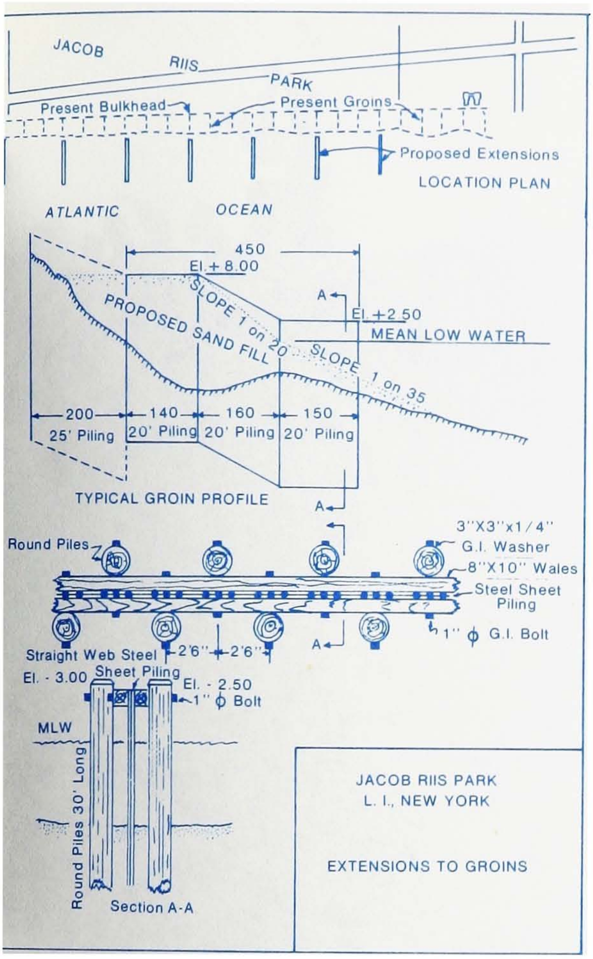
Bottom. Beach Erosion Control Jetties, Barnegat Inlet, New Jersey, 1938.
Source: The National Archives, Washington, DC.

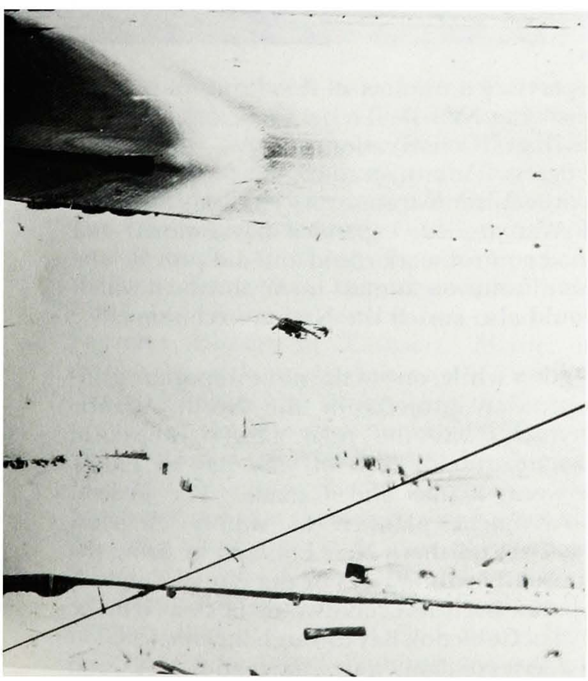


Engineer, recommending five instead of seven. He agreed with those at East Hartford, Springfield, West Springfield and Holyoke, but he did not find that the two dikes proposed for the protection of Chicopee and Northhampton were warranted. The annual costs of the dikes in those two river cities, he concluded, exceeded annual benefits, even after a liberal crediting of the benefits. The ratio of annual benefits from restored property values and other items as compared with costs in these cities was estimated at 0.9, or less than balanced and therefore not justified. Additionally, the two cities unlike the others, had not proposed any local participation in the cost of construction.

The negative recommendation of the Division Engineer galvanized the local interests at Northhampton and Chicopee into a reassessment of their situation and of the Corps' analysis. Representatives of the two towns received another public hearing, this time before the Board of Engineers for Rivers and Harbors. The future of the two communities would be jeopardized, they warned, unless they had the same degree of flood protection as the other river cities. In addition, the inhabitants urged the Engineers to take a more liberal view of the benefits resulting from the dikes. The Board of Engineers for Rivers and Harbors considered the information and inspected the sites. Consequently, they decided to include Northhampton and Chicopee in the full flood protection program. In the opinion of the Board:

> . . . . The benefits that would accrue to the seven cities from their protection by dikes are sufficient to justify the United States in undertaking the work, and certain additional benefits of a more or less intangible nature, such as increases in land value and consideration of the welfare and continued security of the people further enhance the value of the proposed improvement.[12]





Top Right.
Restoring Jacob Riis Park Beach, Long Island, N.Y. 1936. To restore the beach at Jacob Riis Park near New York City, the New York District recommended the erection of new groins as the drawing shows, to restrict continued drift of sand. The Engineers also suggested pumping offshore sand onto the beach by a hydraulic dredge.

Thus the dikes remained in the project. Both the Board and the Chief of Engineers concluded, however, that the additional ten reservoirs should not be constructed until Congress and the New England states approved an interstate agency to encourage cooperation in the development of regional flood control.

IV

Other New Missions

Beach Erosion Control, a Tidal Project, and Reduction of Unemployment

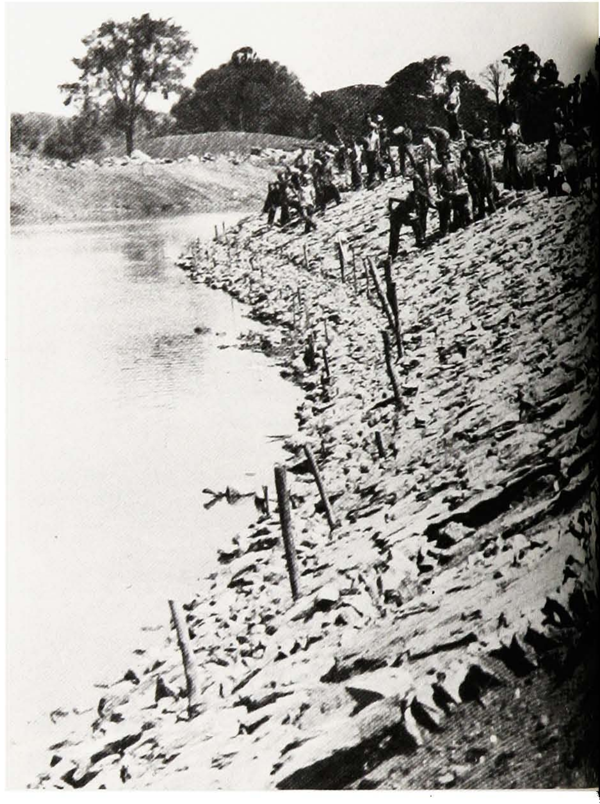
The 1930s brought a number of other, less extensive, new missions to the North Atlantic Division. These included shore erosion control, a tidal power project, and, in the wake of the staggering unemployment of the Great Depression, Congressionally-mandated public works projects to put the jobless to work.

For more than a century, the Corps of Engineers had been primarily concerned with the seacoast as a site for fortifications. But in the 1930's, Congress directed the Army Engineers to study the problem of maintaining the Nation's beaches as valuable natural resources in themselves. This legislation resulted from the growth of seashore recreation facilities and the subsequent erosion of the beaches. In the late 19th and early 20th centuries, railroads and then automobile highways enabled metropolitan residents to get to the seashore for recreation. Along the shores of Long Island and New Jersey, however, the construction of roads, boardwalks, hotels and houses on the barrier beaches tended to stop the lateral movement of sand along the ocean front. Many communities discovered their valuable beaches washing away. Storms and hurricanes, which beat upon the newly built-up areas, compounded the damage.

The Army Engineers began to study beach erosion in the 1930s. At the start of the decade, Congress authorized the Corps to assist local authorities in obtaining information on erosion and on possible protective measures. During the subsequent ten years, the Engineers conducted a number of beach erosion studies. Presented with these findings, the communities themselves then decided whether to act upon the Corps' recommendations. Local governments had to replenish the sand and build protective works such as sea walls, jetties and breakwaters. Not until 1946, did Congress authorize and provide Federal funds for Corps construction of shore protection projects.

Within the North Atlantic Division, several beach erosion studies highlighted the 1930s. The first dealt with the diminishing of the beach at Jacob Riis Park, a municipally-owned seashore resort in New York City, located on a barrier beach separating Jamaica Bay from the Atlantic Ocean. After reconstructing the history of the shoreline since 1835, the Engineers concluded that the beach could best be maintained by having a hydraulic dredge pump offshore sand onto the beach. They estimated the cost at $184,000. They conducted other studies at the Manasquan Inlet, approximately 24 miles south of Sandy Hook, New Jersey, and at the new and artificially-created Orchard Beach on Pelham Bay in New York City. The Engineers evaluated the complicated system of wave actions and currents at Orchard Beach and recommended extension of the sea wall, a new jetty and seawall, and replenishment of beach sand.[13]

During the Great Depression, both the administration of Herbert Hoover and of Franklin Roosevelt increased Federal public works programs in an attempt to reduce unemployment. At its peak in 1932-1933, unemployment reached 30 percent of the workforce. Spending for river and harbor projects doubled to $105 million between 1929 and 1934. Some of these funds went to complete existing navigation improvement projects. The Army Engineers, however, also



supervised a number of flood control projects involving New Deal relief agencies such as the Civilian Conservation Corps, the Work Progress Administration, and the Public Works Administration. As Hoover's Secretary of War argued, expanded navigational and flood control work could and did provide one useful solution to mass unemployment which would also enrich the Nation's economy.[14]

For a while, one of the most important anti-depression projects in the North Atlantic Division was the tidal power project at Passamaquoddy Bay off the Bay of Fundy between Maine and Canada. The Federal Government planned to supply electrical power to northern New England by using the unusually-strong tides of the Bay of Fundy. A separate high-level lake would be created in the area of Cobscook Bay through the construction of a series of dams, gates, navigation locks, and

Wallkill River, New York, Flood Control Project Under Construction by Junior Civilian Conservation Corps Youths, 1936.
Source: The National Archives, Washington, DC.

a powerhouse. Power would be generated by utilizing the shifting difference in height between this pool and the Bay of Fundy. In 1935, President Roosevelt approved the project under the Federal Emergency Relief Act and directed the North Atlantic Division to begin land acquisition and construction. Upon the Division Engineer's recommendation, the Chief of Engineers established a special Engineer District at Eastport, Maine, to oversee the work, on the estimated $62 million project. Under NAD's supervision, the District completed the Pleasant Point and Carlow Island Dams within one year. However, in 1936, Congress reconsidered the project. The Senate decided that the projects' cost would be too high compared with that of a steam-generated electrical power plant in the area. The House refused to appropriate funds on the grounds that the project had never been approved by Congress. Funding was terminated and the Eastport District discontinued as the project came to an end.[15]

V

Traditional Civil Works

River and harbor work continued to be a major concern of the North Atlantic Division in the 1920s and 1930s. Expansion of shipping required improvement of the region's waterways. New York Harbor's commerce, for example, grew from 94 to 137 million tons during the boom years of the 1920's. In the peak year of 1929, some 122 ships passed through the entrance to the harbor each day.

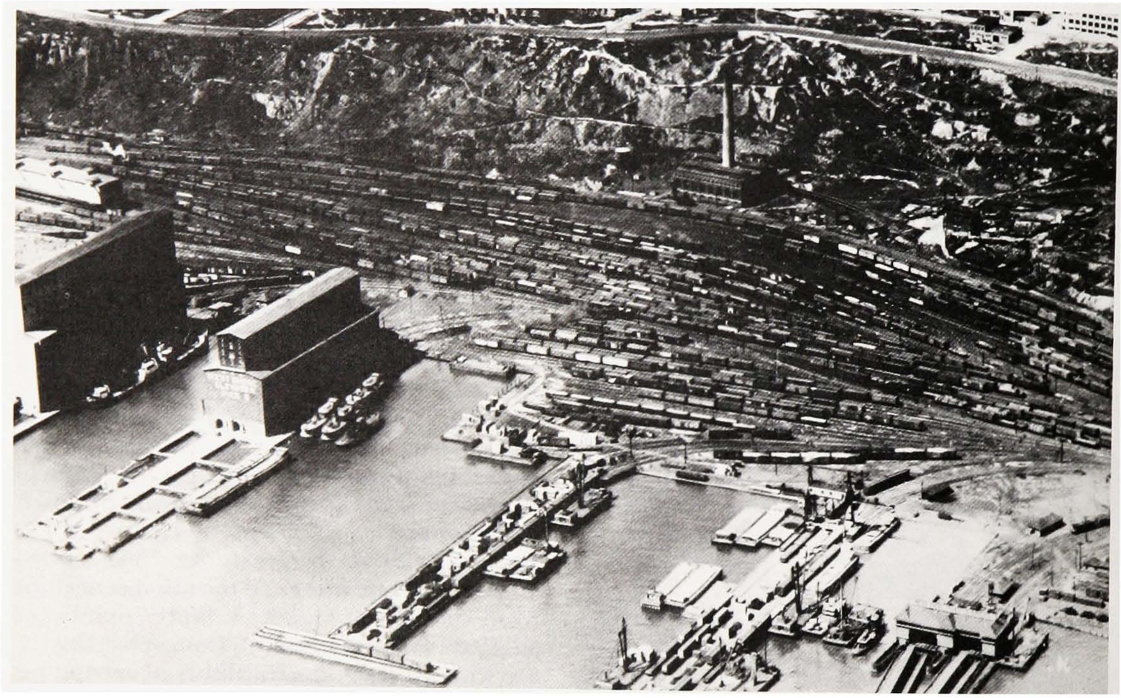
As traffic expanded and the number of ships in the harbor increased, so did the number of ship collisions. As a result, Congress asked the Division to study the feasibility of expanding the channels and anchorage areas in New York Harbor. In 1933, the New York District Engineer recommended an extensive program which would cost an estimated $21 million. Colonel George Hoffman, the North Atlantic Division Engineer, concurred. However, he also recommended that the quarantine anchorage area be transferred from the Upper Bay to the Lower Bay, just outside The Narrows. The Board of Engineers for Rivers and Harbors advocated implementation of the first part of the plan, at a cost of $4 million, but the Board members rejected the Division Engineer's other suggestion. As the Board stated in its report, "While the removal of the quarantine anchorage to Gravesend Bay as proposed by the Division Engineer would greatly improve conditions of navigation at the Narrows, this plan has been strongly objected to by the quarantine officials and is not recommended by the Board."[16] In a different project in 1934, the North Atlantic Division Engineer, Colonel J. A. Woodruff, modified the District Engineer's proposal for

Top. New York Central Railroad Yards and Terminals at Weehawken, New Jersey, 1926.

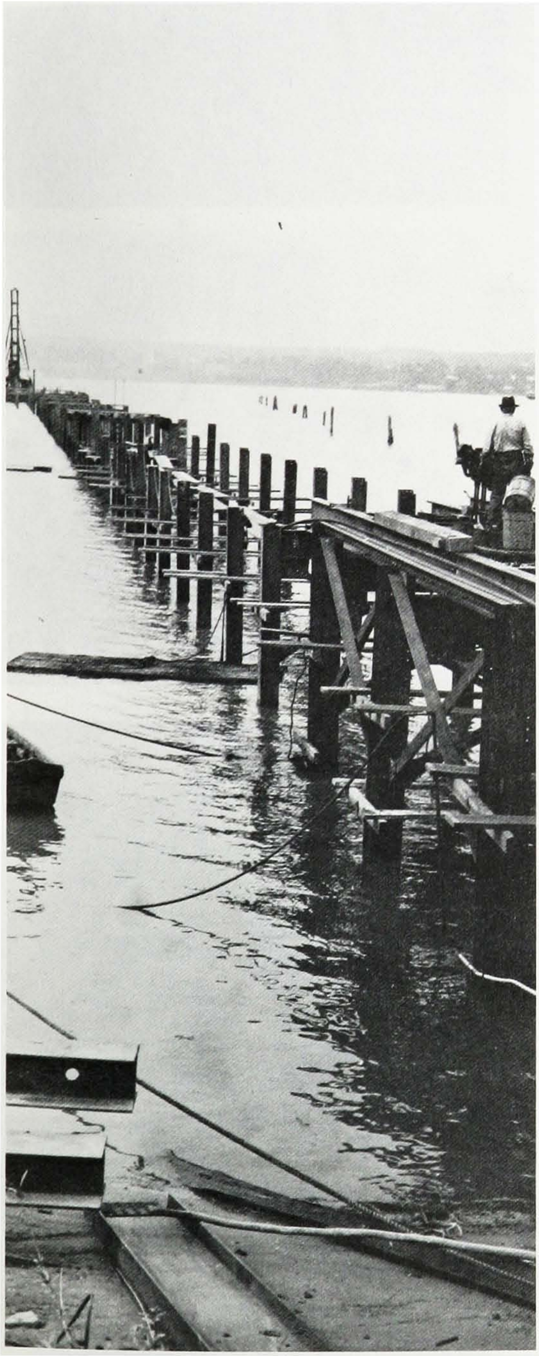
Bottom: Dredging Buttermilk Channel, 1934.

Far Right. Ordnance Depot Pier, Delaware River Under Construction, 1941.
Source: The National Archives, Washington, DC.

deepening of channels and anchorages to cost $27 million instead of $39 million. Colonel Woodruff's assertion that "only such portion should be now authorized as will afford an economic return from the improvement commensurate with the cost," was upheld by the Board and the Chief of Engineers.[17]



Major navigation improvements were also made in Baltimore Harbor and along the Delaware River. The Delaware continued to be one of the main waterways of the Nation. It served as the route to the giant Philadelphia Navy Yard and as the entrance to the Port of Philadelphia, through which nearly $1 billion worth of goods moved in 1935 alone. Since the turn of the century, the Government had spent $43 million deepening and maintaining the Delaware River channels at 35-foot depth. In 1938, both the District and Division Engineers recommended that the channel depth be increased to 40 feet at a cost of $11 million. The Board of Engineers and the Chief of Engineers accepted their recommendation.[18]

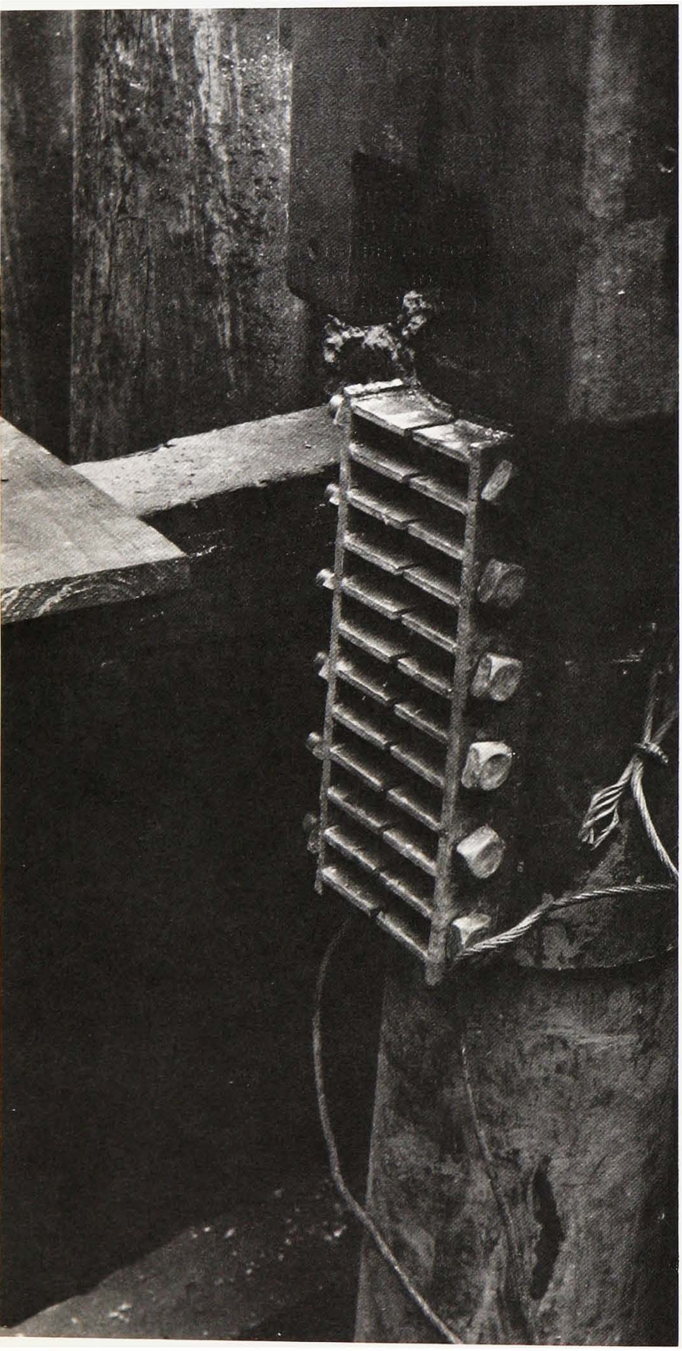


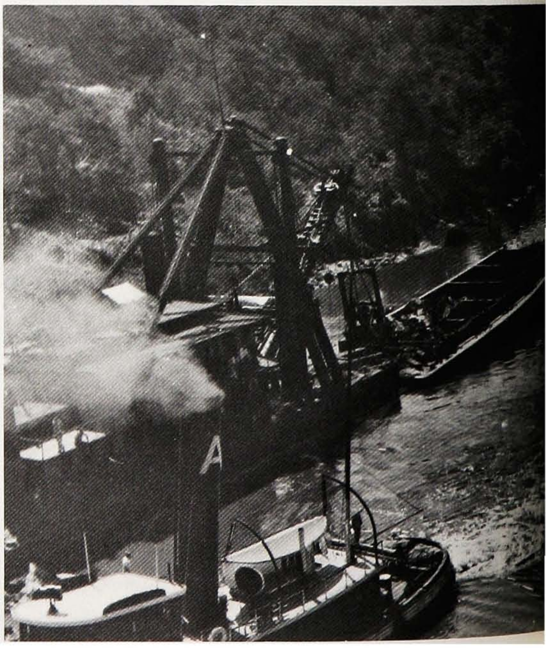
The 1920s and 1930s also heralded a period of intensified canal work by the North Atlantic Division. Work proceeded on the Chesapeake and Delaware, the Cape Cod, and the New York State Barge Canals.

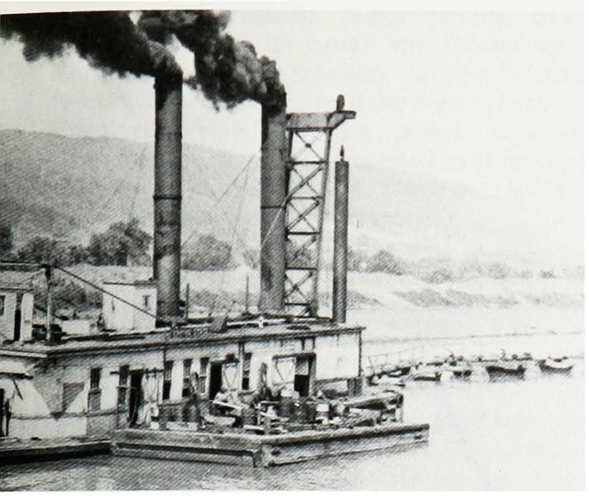
The Federal Government purchased the Chesapeake and Delaware (C&D) Canal and began its modernization in 1921 under the direction of the Wilmington, Delaware, District. Seven hydraulic pipeline dredges, two scoop dredges, one steam shovel and two dragline banking machines converted the waterway from a lock to a sea-level route between the two great bays. To do this, they excavated 16 million cubic yards of material. The Engineers completed the project in 1927 at a cost of $10 million, some $3 million less than originally estimated.

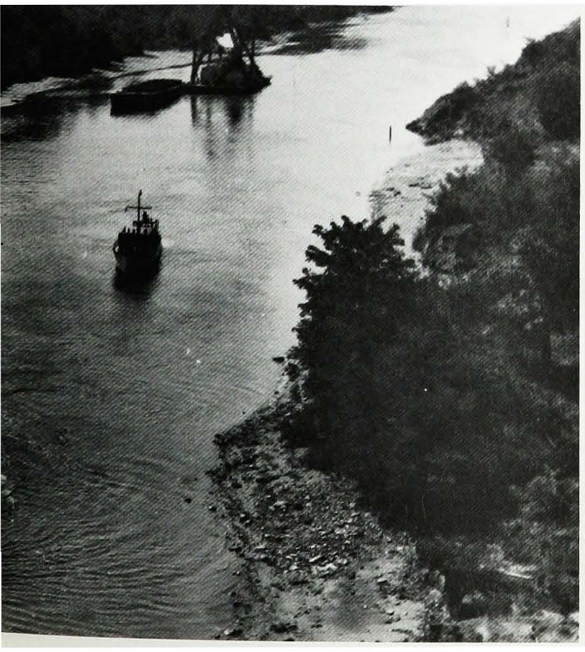
The C & D Canal was further expanded during the 1930's to handle the increased volume of shipping and to help reduce unemployment. In the six years after the reopening of the canal in 1927, traffic doubled on the waterway. In 1933, the Division Engineer recommended that the channel be deepened to 27 feet and widened to 250 feet. The Emergency Relief Appropriation Act provided $5 million for the project. The Roosevelt Administration stipulated that 90 per cent of all workers on the project be hired from the relief rolls. Under the direction of the Philadelphia and Baltimore Districts, formerly jobless workers began to shovel earth along the embankments, while hydraulic dredges excavated material from the canal bottom. Ultimately nearly 35 million cubic yards of material were removed to produce the expanded waterway. Traffic rose from one million tons of cargo in 1935 to a peak of 11 million tons in 1942.

In New England, the Federal Government in 1927 purchased the Cape Cod Canal, connecting Buzzards Bay with Cape Cod Bay. This sea-level waterway enabled ships sailing between Boston and New York to bypass the




A





Far Left. Driving Collar on Pile on Pier at St. Georges Bridge, 1936.

Top. Improving and Extending Waterway Surrounding the Old Erie Canal, 1938.

Center. Erecting St. Georges Bridge Across the Chesapeake and Delaware Canal, 1941.

Bottom. Maintenance Dredging of the Chesapeake and Delaware Canal, 1935.

Source: The National Archives, Washington, DC.

Enlarging the Chesapeake and Delaware Canal.
Extract from a 1923 Inspection Tour:

We inspected the work in progress on the contract for enlargement of the canal west of the Summit bridge. Junior Engineer Hughes, in local charge of the work on the canal, joined us at this point.

Only one pipe line dredge was working, but it was making much better progress than on former visits, on account of the shorter pipe line and somewhat lower elevation to which the material is being pumped. Pumping through a line about 1000 feet long to an elevation of about 60 feet, a maximum output of about 10,000 cubic yards a day had been attained. The steam shovel plant was also in operation, with a capacity of about 30,000 cubic yards a month.

The large new dredge, Number 5, of similar capacity to the "Claremont," which the contractor was building at Chesapeake City, was to have been completed and in service by July 1, but there was serious delay in delivering the ladder, and my last information was that this new dredge would probably not be in operation before August 15. In a very short time it should make up the present deficiency in progress of the work, and the combined capacity of the two dredges will be much in excess of the required rate of progress. The permanent weir at Guthries Run was about completed. With the prospect of the additional dredge being placed in commission in the near future, the work is proceeding satisfactorily.

Colonel H.C. Newcomer, Northeast Division Engineer, to the Chief of Engineers, August 3, 1923, Records of the Office of the Chief of Engineers, District Files #2334, Box 575, Federal Records Center, Suitland, Md.

Top. Corps of Engineers' Vessel Derrickboat HR N1 *Removing Shoal Along the Hudson River.*
Source: The National Archives, Washington, D.C.

Bottom. Corps of Engineers' Hopper Dredge Hoffman *was named for George M. Hoffman, Division Engineer, and was completed in 1942.*

Cape Cod peninsula. After paying $11.5 million to buy the canal, the Government spent $27 million to improve the 13-mile-long waterway. Under the eye of the Boston District, then supervised by the North Atlantic Division, the canal was deepened to 32 feet and widened to at least 205 feet. Three new bridges were built across the waterway.[19]

The most ambitious canal project within the North Atlantic Division involved the New York State Barge Canal. This system of waterways was based upon the old Erie Canal with a number of man-made and natural offshoots. New York planned to extend both the length and depth of this network from Albany on the Hudson River to Oswego on Lake Ontario and Buffalo on Lake Erie. The system included more than 800 miles of 12-foot deep waterways and more than 50 locks. Between 1903 and 1938, the State of New York spent nearly $300 million improving it. Even though the Erie Canal and its successors had been built by New York and existed solely within that state, the Federal Government had always maintained an interest in the waterway. Linking the Atlantic Ocean and the Great Lakes and the Midwest, it had great military and commercial value to the Nation as a whole. The Federal Government had taken over its operation temporarily in World War I.

During the Great Depression, state and Federal authorities supported Federal assistance in the expansion of the waterway. A special Board on a Deeper Waterway was appointed under the chairmanship of the North Atlantic Division Engineer, Colonel George Hoffman. Confirming that expansion of the canal was in the national interest, the board recommended a $27 million program to deepen the system to 14 feet, widen it to between 100 and 200 feet, and raise more than 260 bridges to provide 20-foot vertical clearance. Under the Emergency Relief Appropriation Act of 1935, Congress authorized Federal assistance. To implement it, the New York District and the North Atlantic Division worked with the State of New York, which continued to have primary responsibility for the Barge Canal. Modernization proceeded from 1935 through 1968.

Increased responsibility for the Corps' floating plant came to the North Atlantic Division in the late 1930s. The Division already oversaw the dredges and other vessels in its various Districts. But in 1938, it received jurisdiction over the Marine Division which designed, supervised production and inspected the Corps' fleet.

The Marine Division was established in 1908 within the Office of the Chief of Engineers. By the 1930s, it had expanded from a ship draftsman and a clerk to a staff of 30 persons. In 1938, the Marine Division moved from Washington, D.C. to Philadelphia, where it became part of that Engineer District. The relocation put the Marine Division closer to the shipbuilding industry and affiliated it with an operating District which had contracting officers. During the next four years, the Marine Division designed and built many small craft and two large hopper dredges, the *Hains* and the *Hoffman*. The latter commemorated the late North Atlantic Division Engineer, George M. Hoffman. At first, the Marine Division received only nominal supervision from the North Atlantic Division, because the Office of the Chief of Engineers continued to exercise direct supervision. Only in the years after World War II, when a special supervisory unit was created in the NAD headquarters, did the Marine Division begin to report directly to New York instead of Washington.[21]

VI

Conclusion

During the 1920s and the 1930s, the Nation experienced sharp economic and political shifts as the business cycle plunged from prosperity to pervasive depression. In these years, the North Atlantic Division operated within a changing environment in which economic, political, and social expectations and assumptions fluctuated rapidly. However, like the rest of the Corps of Engineers, NAD successfully adjusted to the new conditions. The agency continued to perform functions which society considered valuable.

In this era, the Army Engineers received tasks which reflected the Nation's increased concern for economic and social security. To bolster commerce and the economy, NAD improved the region's rivers and harbors, and it modernized a number of canals. It received new assignments to aid local communities. It assisted them in reducing the erosion of their valuable beachfronts. It directed a comprehen-

sive program of flood control to limit damage to homes, businesses, and farmlands in the region's river basins. NAD helped to take the jobless off the relief rolls and put them to work on constructive projects.

These assignments reflected part of a continuing trend towards the nationalization of problems and issues. The Federal Government became increasingly involved in what had previously been considered local matters. It had the means and the ability to deal with what was seen as common problems through the Nation. Beach erosion, flood control and unemployment relief were part of this trend toward providing national assistance in meeting needs which overwhelmed local communities.

The situation also represented part of the continuing interaction between NAD and the changing environment in which it operated. When the President and Congress accepted Federal responsibility for action in areas such as flood control, they found an organization already available for use. The Corps of Engineers adapted its skills and structure to the changes. The new missions resulted in increased appropriations, more equipment, larger staffs, additional specializations, and even new Districts. The Corps was flexible enough to accommodate these.

These alterations in the organization created changes in the environment in which the Army Engineers operated. They brought new benefits to the local communities, the region, and the Nation. These in turn led to an enhanced image for the Corps of Engineers. More than anything else in these years, flood control brought the Corps and the Division to the public's attention as never before. It helped to create a new political and economic climate in which the Army Engineers received civil works assignments.

The depression-fueled civil works responsibilities expanded the North Atlantic Division's activities during the 1930s. In the 1940s, American participation in World War II would magnify NAD's reputation and responsibility in the cause of national defense in a manner that would affect its role for years to come.

CHAPTER 4.

Across the Seas: The Whirlwind of World War II, 1940-1945

I

Introduction

World War II posed a new challenge to America. Like the other units of the Corps of Engineers, the North Atlantic Division responded to demands of global war. Throughout the world, Army Engineers built airfields, roads, ports, petroleum pipelines, military camps and cantonments, warehouses, hospitals, and dozens of other facilities necessary for victory. A number of their accomplishments won public acclaim. The most notable included the Alcan Highway to Alaska, the Ledo and Burma Roads through mountains and jungles of Asia, and the clearing of mines and underwater obstacles from the Normandy beaches before the D-Day Invasion. So important were the efforts of the Corps, that General Douglas MacArthur called World War II "an engineer's war."

The North Atlantic Division played a vital role. With the major East Coast ports located in its area of jurisdiction, NAD served as a conduit for goods flowing to American Engineer troops in the European, North African, and Middle Eastern Theaters of Operation. It became directly involved in the procurement, storage, and shipment of hundreds of millions of dollars worth of equipment and supplies. Furthermore, NAD supervised construction of the first American overseas bases, in Greenland, Bermuda and Iran. In Canada, it built bases which enabled the Army Air Corps to shuttle planes to airfields in Britain. Through its Districts, NAD oversaw the construction of airbases, Army camps, depots, and a variety of other military facilities in the Northeastern United States. NAD also played a part in the super-secret development of the Atomic Bomb.

II

Reorganizing for Wartime Missions

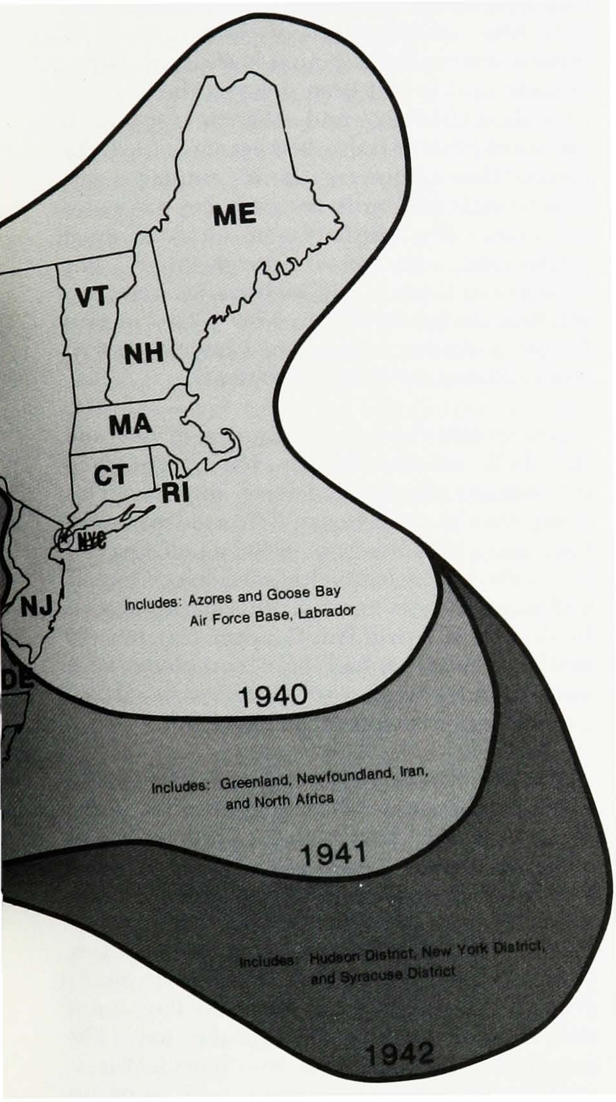
Like a whirlwind, the American war effort spun the North Atlantic Division around

pointing it in new directions. The war changed NAD's primary focus from civil works to military projects, and it centered many of those projects outside the United States. The Division added new Districts, hired more employees and obtained additional offices to perform its new tasks.

In the year after the American entry into the war, NAD's office force increased nearly tenfold. The number of employees jumped from 300 to 2,500. Military officers increased from three to 150. The payroll swelled from $560,000 to $4,900,000. This represented only the Division Office staff. In addition, the Division Engineer became directly responsible for Corps of Engineers employees who maintained the utilities equipment on Army bases in the First and Second Army Service Command Areas in the Northeast. This meant NAD had responsibility for another 2,700 employees. It was a period of dizzying change for the Division.[1] "We jumped from small to big so fast that the work one individual had been doing became the responsibility of a whole section, involving perhaps half a dozen persons," the former chief of the Engineering Division recalled. His own staff increased from a dozen to 130 persons.[2]

This rapid expansion of the office force required the Division to set up a variety of training programs. The training period depended upon the employee's previous experience and adaptability, and on the nature of the position. Records Section trainees needed less than two months to learn to work in files, records, mail, or in messenger service. However, the Cost Section of NAD's Fiscal Division required two years or more to prepare a fully qualified employee for Government cost accounting. In most sections, however, new employees were trained in less than six months. In labor relations work, so vital because of the Division's involvement in construction, guidelines stressed that trainees "must enter this field possessed of no fixed affiliation for either Labor or Employer."[3] "The hard and fast rules that must be learned, retained, and forever followed" the guidelines stated, "are those of fairness to both Labor and Employer, based on existing laws, regulations, directives, and contracts."[4]

Diagram and Map of NAD Geographical Responsibilties During World War II.



Biographical Sketch

Brigadier General Beverly Charles Dunn
Division Engineer, 1942-1944, 1946-1948

The man in charge of the North Atlantic Division during the peak of its wartime activity was General Beverly Charles Dunn. The son of a West Pointer, the Virginia-born Dunn was graduated seventh in his class at the Academy in 1910. As a second lieutenant in the Engineers, he received an assignment to river and harbor work in the Rock Island, Memphis and Pittsburgh Engineer Districts. He later worked on construction of the Panama Canal. After attending the Engineer School at Washington Barracks, now Fort McNair, he was ordered to the Philippines. There he conducted a military survey of Luzon in 1914 and worked on the fortifications of Caballo Island. In 1916, he returned to the United States as a captain for assignment in New Orleans.

The entry of the United States into World War I temporarily shifted General Dunn's career away from civil works. He served as adjutant of the 10th Engineer Forestry Company, then taught military engineering at West Point. In 1918, he helped train replacement Engineer troops. From 1919 to

1921, he taught at the Engineer School. Promoted to major, he returned to river and harbor work from 1921 to 1927, spending two years in New York City and five years in Rock Island, Illinois. For two years, he served in the Planning Branch of the Office of the Assistant Secretary of War, then from 1929 to 1932, he worked in the Office of the Chief of Engineers. During the 1930's, he was assigned to river and harbor duty at Jacksonville, served another tour of duty in the Office of the Assistant Secretary of War, and, as a colonel, was placed in command of the 6th Engineers at Fort Lawton, Washington.

When the United States entered World War II, General Dunn served as a District Engineer in Seattle, but he soon received a promotion. As a Brigadier General he was appointed on April 1, 1942 as North Atlantic Division Engineer. He served in that capacity for nearly two years during the height of the American military effort. In 1944, he became General Eisenhower's deputy chief engineer in charge of the Allied Invasion of France. His Engineers cleared the beaches at Normandy of mines and obstacles and, after the assault, they established debarkation and supply facilities which served the Allied Armies for nearly six months. In December 1944, General Dunn was appointed Chief Engineer of the Supreme Headquarters Allied Expeditionary Force, a position he held during the Allied drive across the Rhine and into Germany itself.

In the postwar period, General Dunn returned to river and harbor duty in the United States. With the demobilization and reduction in the size of the Army, Dunn resumed his rank of colonel. For a year, he served as Ohio River Division Engineer. Then in November 1946, he was reappointed to head the North Atlantic Division. He held that position during the difficult period of transition from war to peacetime operations. He retired from the service as a brigadier general in 1948 and became chairman of the board of James King and Company, a major contractor with headquarters in New York City.[5]

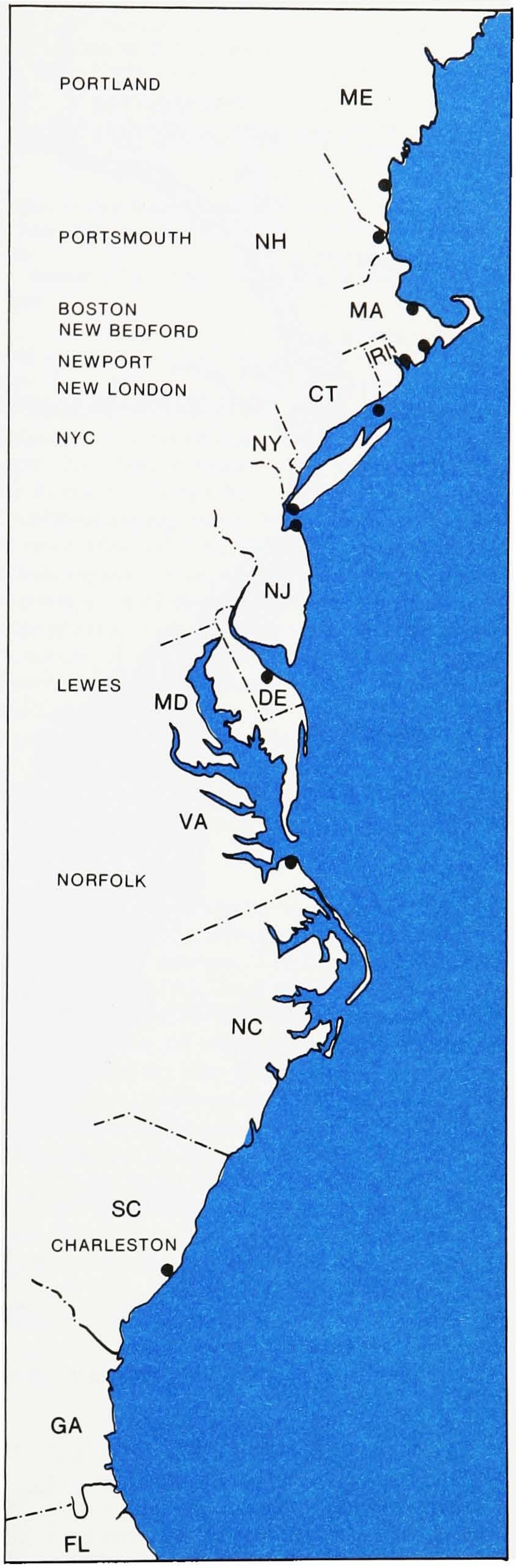
The expansion of defense activities in the years between 1940 and 1945 led to some major reorganizations within the Corps of Engineers. Several new districts were created and came under the supervision of the North Atlantic Division. In addition, the increase of construction activity along the East Coast eventually led the Chief of Engineers to create two new Divisions — the New England and and Middle Atlantic — to ease NAD's workload.[6]

Traditionally, one of the main defense responsibilities of the Army Engineers had been the construction of fortifications to protect America's principal harbors. Relatively little of this had been done in the interwar period. A few 12- and 16-inch guns, with ranges of 17 to 30 miles, had been installed. For them, the Engineers built emplacements which included bulls-eye concrete pivots for the guns. The emplacements had minimal earthworks and no overhead cover. The Districts in NAD put these batteries in Boston Harbor, on Sandy Hook, New Jersey in Fort Eustis at the entrance to the Chesapeake Bay, and at Slaughter Beach, Delaware.

The outbreak of war in Europe in 1939 and the fall of France in 1940 prompted resumption of harbor defense improvements along the Atlantic Coast. The modernization program which began in 1940 included a series of nearly 150 batteries designed to prevent air and naval attacks against the American coast. By the end of World War II, approximately 100 of these batteries had been completed with guns ranging from 6 to 16 inches in caliber. The defense system cost $220 million.

Within the North Atlantic Division, Engineers located the largest batteries — the 12- and 16-inch guns — at the outer reaches of nearly a dozen waterways. These included Portland, Maine, Portsmouth, New Hampshire, Boston, New Bedford, the entrance to Narragansett Bay, the eastern entrance to Long Island Sound, New York Harbor at Sandy Hook, Cape Henlopen at Delaware Bay, and at the entrance to the Chesapeake Bay. The standardized batteries of the World War II system usually contained two guns in reinforced concrete casemates or bunkers behind heavy armor shielding. Located some 500 feet apart, the big guns received protection from concrete and earthen canopies up to 20 feet thick. The Engineers designed these bunkers to withstand direct hits from naval guns or aerial bombs. To direct the gunners, five-story, circular, concrete fire control towers stood nearby.

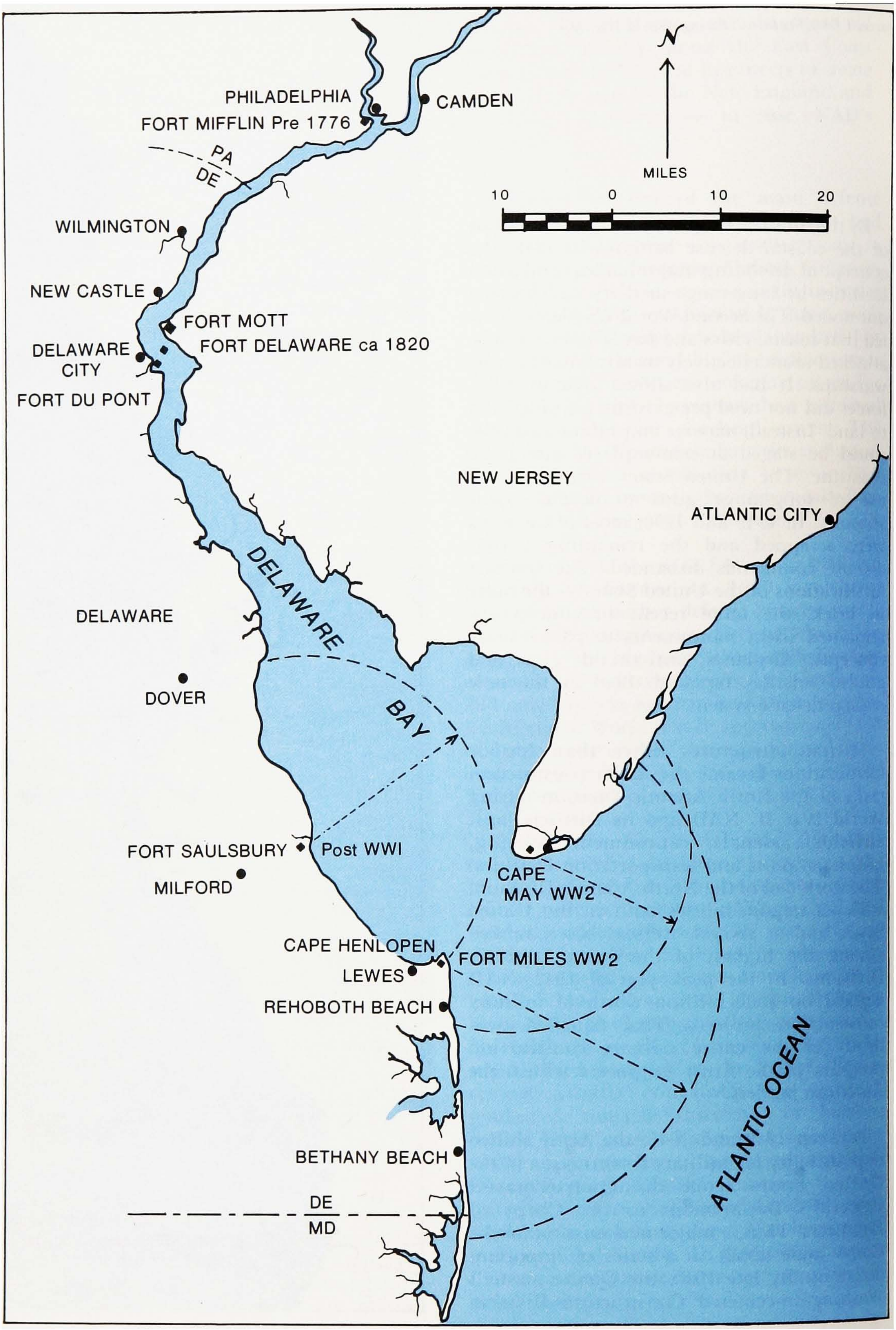
Seacoast Fortifications During World War II.

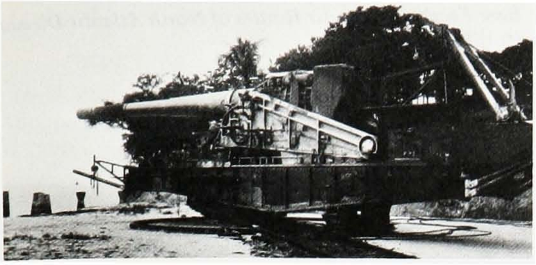


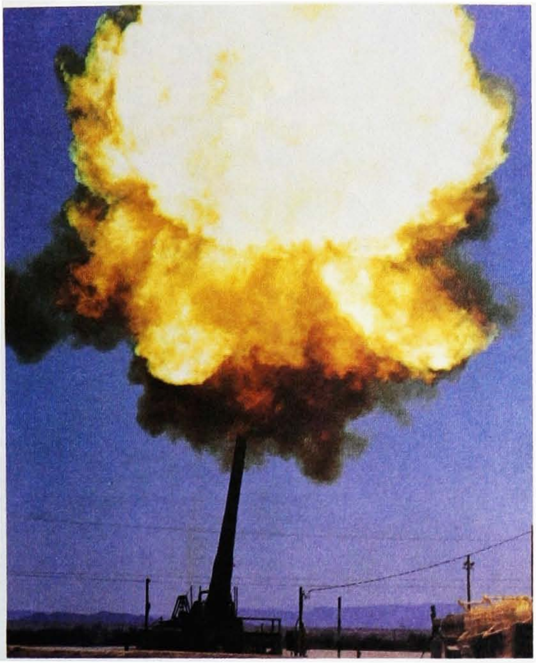
By the time the Engineers completed the last of the coastal defense batteries in 1948, the concept of defending major harbors and naval facilities by long-range artillery had become outmoded. The Second World War demonstrated that coastal cities and naval bases could be attacked more effectively by airplanes than by warships. It had also shown that invasion forces did not need pre-existing port facilities to land. Instead, massive amphibious assaults could be staged at many places along the coastline. The United States abandoned the use of long-range guns to defend major seaports. In 1949 and 1950, most of the guns were scrapped and the remaining harbor defense commands disbanded. The seacoast fortifications of the United States — the older in brick, the more recent in concrete — remained silent monuments to past defense concepts. Airplanes, anti-aircraft guns and guided missiles replaced them as the new coastal defense system.[7]

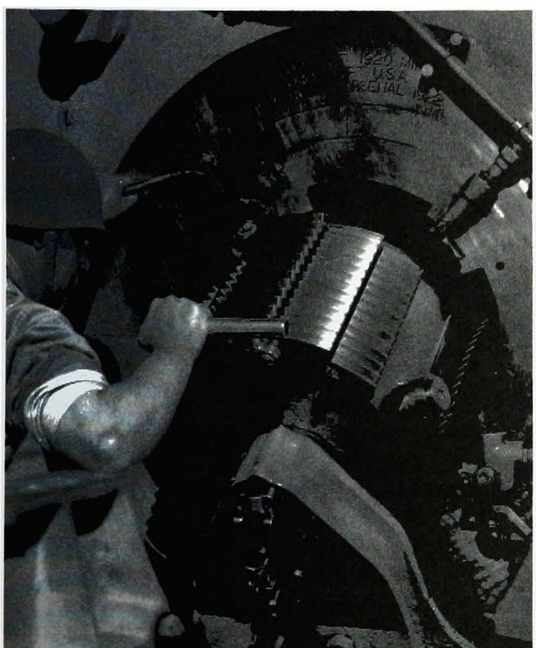
Military structures other than harbor fortifications became the major construction tasks of the North Atlantic Division during World War II. NAD and its Districts built airfields, arsenals, cantonment housing, hospitals, ports and transportation facilities. The workload of the North Atlantic Division, with its responsibilities both in the United States and at several overseas bases, ranked among the highest of the dozen Engineer Divisions. In the peak year of 1942, NAD worked on $500 million worth of military construction projects. That equalled two-thirds of the entire military construction program of the Army Engineers within the American borders.[8]

Between 1940 and 1941, the Army shifted responsibility for military construction in the United States from the Quartermaster General's Department to the Corps of Engineers. Thus, a major new mission for the Corps came about in a series of important decisions. By late 1940, the Quartermaster's Washington-centered Construction Division


N
MILES
10
0
10
20
PHILADELPHIA
CAMDEN
FORT MIFFLIN Pre 1776
PA
DE
WILMINGTON
NEW CASTLE
FORT MOTT
FORT DELAWARE ca 1820
DELAWARE CITY
FORT DU PONT
NEW JERSEY
ATLANTIC CITY
DELAWARE BAY
DELAWARE
DOVER
FORT SAULSBURY
Post WWI
MILFORD
CAPE MAY WW2
CAPE HENLOPEN
FORT MILES WW2
LEWES
REHOBOTH BEACH
ATLANTIC OCEAN
BETHANY BEACH
DE
MD







Far Left. During World War II Construction of Fortifications Shifted Seaward Due Mainly to Advances in Armament Technology, Which Provided Ranges Up To 25 Miles.

Top. A 14-Inch Railway Gun in the Interwar Period.
Source: The National Archives, Washington, DC.

Center. Muzzle Blast of a 16-Inch Coastal Defense Gun.
Bottom. Slamming Shut the Breach Block on a 14-Inch Gun.
Source: U.S. Army Audio Visual Branch, Signal Corps.

and its regional zone organization came under fire for delays and cost overruns in the expanding military construction program. Beginning in November, the War Department gave the Army Engineers the job of building all Army Air Corps Bases on the Atlantic and Caribbean Island bases leased from the British in return for old U.S. destroyers. Authorities in Washington recognized the decentralized organization of the Corps of Engineers as more appropriate than the more-highly centralized structure of the Quartermaster's Department. Furthermore, the Corps had experience building airfields for the Civil Aeronautics Authority in the 1930s. On December 1, 1941, six days before Pearl Harbor, President Roosevelt signed legislation which transferred all military construction to the Corps of Engineers.[9]

The Corps maintained its decentralized structure as a valuable asset in conducting the extensive new mission. The Chief of Engineers and the head of his Civil Works Division dealt mainly with policy and administration. They left the work of supervising and executing construction to the Districts and Divisions. Unlike the Quartermaster officers, Engineer field officers had a great deal of autonomy. By 1942, District Engineers had received authority to execute contracts up to $2 million and Division Engineers could sign agreements for up to $5 million. These field officers continued to have direct responsibility for real estate, repairs and utilities, labor relations, and construction operations. As the Chief of Engineers, Major General Eugene Reybold, declared in March 1942:

> The Army Engineers still are operating on the principle of decentralization. We are still 'giving a good man a job,' we are still 'giving him the authority and the means,' and we are still letting him 'go to it.' In time of

Below. Recommendation to Transfer Army Construction from Quartermaster Corps to the Corps of Engineers, 1941.

WAR DEPARTMENT
OFFICE OF THE UNDER SECRETARY
WASHINGTON, D. C.

August 28, 1941

MEMORANDUM FOR THE PRESIDENT:

Subject: Transfer of Army Building Construction to Corps of Engineers.

The present law requires that building construction for the Army be done by the Quartermaster. In 1940 Congress provided that the Secretary might assign part of the construction program to the Engineers. The Secretary, accordingly, assigned all Air Corps construction and all work on the Atlantic island bases to the Engineers.

The result is that now two-thirds of the construction work is being done by the Quartermaster, one-third by the Engineers.

I have drafted a bill which will put all Army construction work with the Engineers. It seems plain: first, that responsibility for construction work should be concentrated in one branch; second, that the Corps of Engineers is the branch best suited for handling the work.

The Engineers, as you know, do a great deal of civilian construction in normal times, rivers and harbors, flood control, etc., and are a going concern. The Quartermaster, on the other hand, has normally no adequate organization to handle construction. If we had had the Engineers on the entire construction program last year they would have moved in with an experienced organization and much waste would have been avoided.

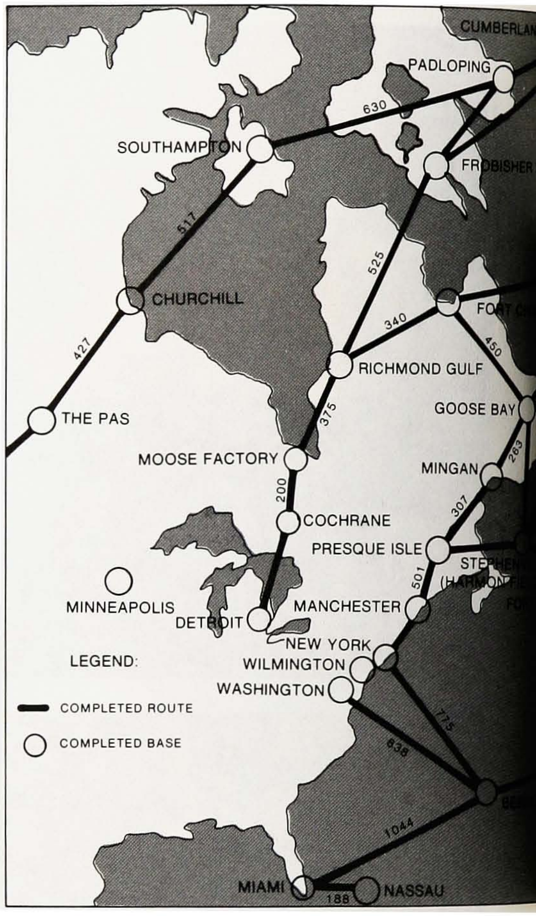
The Secretary of War, the Chief of Staff and all others in the War Department familiar with the problems, are in favor of placing this entire work with the Engineers.

If you will give your approval, I will advise the Budget that the bill is in accordance with your policy and will take the necessary measures.

Robert P. Patterson,
Under Secretary of War.

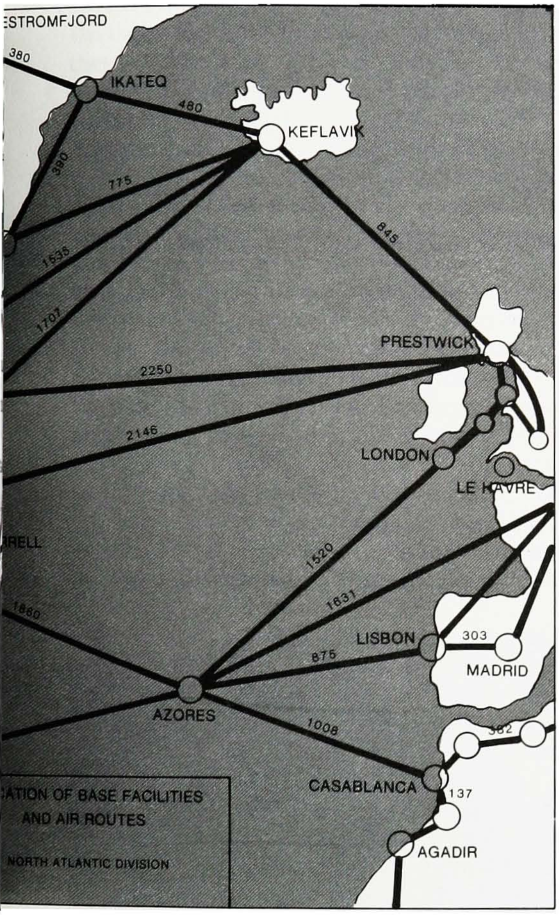
OK FDR
8/29/41

Base Facilities and Air Routes of North Atlantic Division in WWII.



peace this system was highly beneficial — in time of war it is more than beneficial — it is vital.[10]

The methods that the Corps of Engineers had successfully developed in years of river and harbor work were applied to the wartime Air Corps construction projects. The Engineers' cost accounting system, which historians Lenore Fine and Jesse Remington have called the oldest and possibly the best in the Government, was put into effect on all air base projects. Furthermore, the District purchasing departments, which had long been familiar with local markets and suppliers, assisted contractors in obtaining scarce materials. District labor relations officers continued their practice of settling labor disputes on a local basis. Work previously handled by the Quartermaster's regional finance officers was



taken over by the disbursing officers of the local Engineer Districts.

As military projects mushroomed and civil works declined, the Chief of Engineers instituted organizational changes and shifted jurisdictional boundary lines. The workload had increased in some regions, such as the East Coast, more rapidly than in other areas of the country. Therefore, in the spring of 1942, General Reybold established several new Divisions to keep pace with this expanded construction activity. Among the new units were the New England Division with headquarters in Boston and the Middle Atlantic Division with its headquarters in Baltimore. The North Atlantic Division, from which these two were carved, maintained its jurisdiction over New York, New Jersey, and Delaware. It also received responsibility for a number of construction projects in Canada and overseas.[12]

III

Building Bases Outside the United States

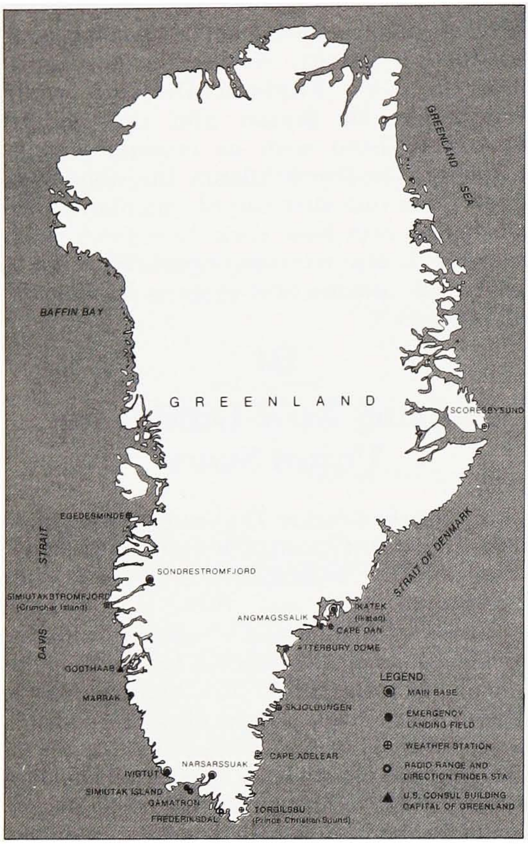
The North Atlantic Division performed a vitally important construction role in the early period of American involvement in World War II. Between 1941 and 1943, it overcame hardships of weather and warfare to build air bases in the cold outreaches of Greenland and Canada. It constructed the famous North Atlantic Ferry Route, a series of air bases which enabled the Army Air Corps to shuttle up to 1,000 planes a month from the United States to Britain. It also constructed air bases in the Caribbean for use against commerce-raiding German submarines. NAD also developed facilities in the Middle East and North Africa to facilitate the flow of lend-lease supplies to America's allies, the Russian armies in the Soviet Union and British forces in Egypt.

These represented the first overseas assignments for NAD and the first time it acted directly as an operating unit rather than a solely supervisory agency. Despite their novelty and monumental size, these wartime missions were accomplished in good time and order.

Bases in Greenland

The $50 million construction of air bases in Greenland represented the North Atlantic Division's first major wartime project as well as its first overseas mission. It began in the spring and summer of 1941 before the United States had officially entered the war. Germany had already conquered most of the Scandinavian and West European countries. In April 1941, the State Department concluded an agreement with the Danish Government in exile authorizing the United States to occupy

the island. The U.S. Government saw Greenland as an important site for protecting convoys and for ferrying planes across the North Atlantic. It was also a major source of cryolite used in making aluminum for the aircraft industry. Furthermore, it served also as an ideal location for tracking storms before they swept over Western Europe.[13]



Left. Map of Greenland with NAD Air Bases.

Below. Swamp Drainage Culvert, Ahwaz-Andimeshk, South of Shahr River.

The establishment of American facilities, code-named "BLUIE" bases, began shortly after the signing of the American-Danish agreement. Ultimately four air bases and thirteen direction-finder and weather stations were erected on the island of Greenland. Coast Guard cutters and Naval ships took the first survey parties of Army Engineers through submarine-infested waters in April and May 1941. The people from the North Atlantic Division did not know what they would find there. When they arrived, they discovered a variety of conditions, all of them severe, on the isolated, unfamiliar arctic terrain. The northernmost point, Sondrestromfjord was located 30 miles north of the Arctic Circle. Heavy ice closed the fjord six months of each year and the ground, which froze during the winter, thawed only to depths of two to five feet in the summer. The base would be exposed to temperatures ranging from 60 degrees above zero in the summer to 50 degrees below in the winter. No one inhabited the area. Construction in such arctic conditions and in such a remote area proved an entirely new experience to the North Atlantic Division and its civilian contractors. Nevertheless, within a month after the survey parties returned to New York in August, NAD obtained contractors to build the air bases and the radio and weather stations.[14]

Work at Sondrestromfjord provides an example of the Division's first overseas operation. NAD contracted with two construction firms, McWilliams and Helmers, to build the base as a joint venture. The base would include a 5,000-foot runway to accommodate B-17 bombers and P-40 pursuit planes, housing for 125 persons (later expanded to 2,400 persons when a hospital was built there), docking facilities for ships, and storage tanks for 2 million gallons of aviation fuel. Nearly 200 civilian employees, accompanied by NAD representatives, began work at Sondrestromfjord in September 1941. While still quartered aboard the Navy transport *Chateau Thierry*, they built unloading docks and a construction base. After moving ashore, they began construction of the permanent facilities. Winds of 165 miles an hour and sub-zero temperature delayed construction for days at a time, but generally work continued through the winter. On January 7, 1942, the first airplane landed on the runway, and in mid-April, the Air Corps accepted the strip as a temporary runway. Spring thaws and excessive settling led to new problems, but the Engineers overcame them. By the end of October 1943, the runway and all of the 250 winterproof buildings had been completed and the Engineers formally turned the $17 million base over to the Army Air Corps.[15]

Changes in NAD Procedure

Construction at Sondrestromfjord and the three other air bases on Greenland taught the North Atlantic Division much about wartime construction in unfamiliar conditions and remote areas. It led to new procedures which NAD and other Engineer units followed in similar wartime assignments.[16]

In the emergency situation, the North Atlantic Division departed from one of the traditions of the Corps of Engineers. Under direction of the Chief of Engineers, NAD worked initially as an operating rather than an exclusively supervisory agency. In the absence of an Engineer District, NAD personnel worked directly on the project. They surveyed the site, obtained a contractor, negotiated contracts, ensured supplies, and supervised construction. In doing so, NAD had to establish new units so that supervisors would not oversee their own work. The deviation from the norm of operating Districts and supervising Divisions was authorized in order to expedite construction in the emergency. As soon as possible — usually within a year — the Chief of Engineers set up new Engineer Districts which took over prosecution of the work.

Within NAD's jurisdiction, these new units included the Greenland, Newfoundland, Hudson and Bermuda Districts. "We tailor-made these temporary new Districts," a long time NAD employee recalled. "We set them up along the lines of organization of the River and Harbor Districts, but we streamlined them and designed them to fit the situation of their mission and area."[17] These temporary wartime Districts consisted of a District Engineer, and a supporting staff in engineering, operations, and some other branches, but they relied upon the Division for much of their administrative support services, such as legal and fiscal work, as well as supervision.

Because of the emergency, the North Atlantic Division, again with the authority of the Chief of Engineers, abandoned other

Top. Enlisted Men's Barracks, Goose Bay Air Force Base, Labrador, Canada.

Center. World War II Construction Project in Kuwait.

Bottom. Gate House at Fort Bell-Kindley Field, Bermuda.

traditions as well. One was the practice of advertising for bids and selecting from among competing contractors. Instead, as NAD's Deputy Division Engineer informed the Chief of Engineers in regard to the Greenland project:

> The secrecy of the project, the necessity for initiating the work without waiting for completion of plans and specifications, and the limited number of constructors who are qualified, and whose dependability is well known to the Department, make it necessary to negotiate this contract rather than put it out for bid.[18]

In the Greenland operation, the North Atlantic Division recommended a cost-plus-fixed-fee contract with the two constructing firms. It did so because it found it necessary to initiate the work without waiting for the preparation of plans and specifications. Other contributing reasons were the flexibility required in the scope of the project, and the many problems caused by the unusual climatical and geographical conditions in Greenland. These would have to be worked out as construction progressed. The Engineers fixed the maximum fee at 5 per cent of the estimated cost of the operation.[19]

NAD supervised and assisted the civilian constructors in a number of ways. Its procurement officers approved purchase requisitions and arranged for shipping and expediting materials. As a first step, NAD established a designated port of embarkation for priority treatment for supplies necessary for construction of the Greenland air bases. NAD also helped expediate the recruitment and clearance of workers. For the arctic construction project, McWilliams-Helmers established an employment office in Superior, Wisconsin in order to obtain workers familiar with cold weather work. The Chief Health Officer at NAD modified existing procedure and

arranged to have physical examination and immunization of the workers done in Wisconsin rather than in New York. This change in procedure considerably reduced the processing time and helped speed the workers directly from Wisconsin to Greenland. NAD also arranged with local draft boards to allow the contractor's employees to leave the United States to work on the overseas bases.[20]

Bases in Canada, Caribbean and Middle East

The North Atlantic Division also built more than a dozen bases in Canada for the North Atlantic Ferry Route. Between 1940 and 1943, it spent $60 million constructing air bases and support facilities on St. John's Island in Newfoundland Province. A number of other Air Ferry bases were constructed in those years by NAD in the Canadian provinces of Quebec, Newfoundland, Manitoba, and the Northeast Territory. These included the $6 million Southhampton Island Air Base at the northern end of Hudson Bay, Churchill Station at the western shore of the Bay, LePas Base in west-central Manitoba Province, and the Padloping radio and weather station, some 45 miles north of the Arctic Circle. NAD built other bases at Mingan on the northern shore of the Jacques Cartier Straits; at the head of Melville Lake in Labrador; at Fort Chimo, some 30 miles up the Loosock River in Quebec, and at Frobisher Bay Air Base on the southeastern end of Baffin Island.[21]

Not all North Atlantic Division construction took place in such icy climes. NAD also erected bases and ports in Bermuda, Cuba, North Africa and the Middle East. The Caribbean bases were designed to serve anti-submarine aircraft and to ferry planes via the Azores to North Africa and the Soviet Union. As with Greenland, NAD approved plans and specifications and assisted District Engineers and contractors in securing men and supplies. They turned the Bermuda air base over to the Air Corps in June 1943 at a construction cost of $40 million. NAD also built Batista Field outside Havana, Cuba. The NAD Division Engineer executed the contract for the Cuban air strip in 1942 and NAD established a field office in Miami to expedite construction. The air base was completed by the spring of 1943.[22]

Between 1941 and 1943, the North Atlantic Division supervised Engineer Districts in the Middle East and North Africa. These units constructed facilities to channel lend-lease goods to the Soviet Union and to the British forces battling the Afrika Korps in Egypt. The projects, the farthest from NAD's New York headquarters, presented new challenges of weather, local conditions, and administrative relations. Iraq and Iran needed port, transport, storage, assembly, maintenance and training facilities so that U.S. goods could be unloaded at Persian Gulf ports. They would then be put together in assembly plants, and transported by land to Egypt or Russia. The Engineer of the Iranian District held an ambiguous position. He reported in different areas, to the North Atlantic Division Engineer in New York and to the Chief of the U.S. Mission in Iran. Through voluntary agreements between these two supervisors, the District Engineer developed a mutually-satisfactory working relationship with both of them.

Nevertheless, the Middle East District Engineers faced continual shortages of labor, equipment and ships. They had to work out agreements with local sheiks and tribal leaders. Their crews had to work in summer temperatures which soared to 140 degrees in the shade. In the two years that NAD supervised these Districts, the Engineers built port facilities, bridges, roads, wharves and assembly plants where virtually none had existed before.

The North African District did the same in Egypt, Khartoum, Sudan, Eritrea and Palestine. At the height of activity in 1942, some 300 persons in the NAD office supervised work in the Middle East and North Africa. In 1943, the Corps of Engineers converted its overseas construction operations from civilian to military personnel. At that time, the Chief of Engineers transferred the work of the Iranian and North African District Engineers and the suspervision of the North Atlantic Division to the authority of the commanding generals in those areas.[23]

IV

Military Construction in America

Unlike the work at overseas bases, military construction within the United States came

under existing Engineer Districts. As customary, in this assignment, NAD exercised primarily a supervisory role.

At home as abroad, top priority went to airfield construction. During the 1930s, NAD's Districts had built Civil Aeronautics Authority airfields with WPA funds at Millville and Newark, New Jersey; at Dover, Delaware; and in Westchester County, New York. The Engineers expanded and improved airports at Allentown-Bethlehem, Reading, and Philadelphia, Pennsylvania; Cape May, New Jersey, and New Castle, Delaware. During the war, they built or improved nearly every Army Air Corps base between Maine and Virginia. These included major air bases at Bangor, Maine; Fort Dix, New Jersey; and Hampton Roads, Va. NAD's Providence, Rhode Island District Engineer, Lieutenant Colonel John S. Bragdon, contributed a major innovation in dispersal camouflage in 1940 which was widely copied throughout the country. He successfully blended the New Bradley Air Field near Windsor Locks, Connecticut, into the tobacco-farming countryside. As such it served as a model of so-called passive protection measures.[24]

Almost as important as airfield construction was the completion of a variety of military structures, including cantonments, arsenals, hospitals, and other buildings. Supervised by the North Atlantic Division, Army Engineers put up prefabricated two-story wooden barracks at Fort Dix, Indiantown Gap Military Reservation, Carlisle Barracks, and elsewhere. They modernized Picatinny Arsenal in Dover, New Jersey, Frankford Arsenal in Philadelphia, and Edgewood Arsenal in Maryland. When completed in 1943, the Middleton, Pennsylvania, Ordnance Depot stood as the Air Corps' largest depot, with storage space for 250,000 parts. The Engineers built hospitals at Valley Forge, Atlantic City, and elsewhere. Although military construction within the United States reached a peak in the summer of 1942, many projects continued in subsequent years.

Special Projects

The North Atlantic Division played a part in several special projects during the war. Among these were the operation of concrete testing facilities at West Point, the design and construction of the Corps of Engineers' fleet and preparation of facilities for the construction of the Atomic Bomb.

The Central Concrete Laboratory, located at the U.S. Military Academy, served as one of several of the Corps' regional laboratories. Some 74 field employees, supervised directly by the North Atlantic Division, worked in the laboratory in 1942. They tested samples of concrete sent there by project engineers from construction sites throughout the region so that the Corps could establish quality control over the concrete used by its contractors. After the war, the laboratory was transferred to the U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.[25]

The program of the Marine Division also expanded to meet defense needs. The Philadelphia-based unit built and leased dozens of vessels for use in Europe, the Pacific, and the United States. The Engineers armed hopper dredges and sent them overseas to deepen channels and harbors captured from the enemy. To overcome power shortages in harbor and landing areas, Engineers built floating power plants. They also constructed diesel-powered ocean-going tugs, steam-powered tow boats, and 500 steel barges to move oil along the East Coast. Some 50 new derrick boats went as lend-lease to America's Allies. As in the past, NAD continued to perform limited supervision over the Marine Division, which reported directly to the Chief of Engineers in Washington.[26]

The development of the Atomic Bomb, code named the Manhattan Project, became the most important special program affiliated with the North Atlantic Division. The Corps of Engineers played a significant role in the construction of the world's first nuclear weapon.[27] In the spring of 1942, President Roosevelt authorized a concerted effort to produce a nuclear bomb before the Germans built one. The Manhattan Engineer District was established to build the plants for the construction of the atomic fission bombs.

The North Atlantic Division provided some of the personnel and much of the early administrative support for the fledging District and its secret project. The Division had performed similar tasks for other embryo Districts. "We were like a mother taking care of

a baby," a long-time member of the NAD staff remembered. "We aided the Manhattan District until it was strong enough to shift for itself."[28] Until the new unit completed its own staff in 1944, NAD provided administrative, fiscal, legal, and other services. In addition, many of the Corps' employees who worked on the Manhattan Project came from the Syracuse District which had been supervised by the North Atlantic Division. This resulted from the appointment of Colonel James C. Marshall, former Syracuse District Engineer, to be project engineer on the construction of plants for the atomic fission bombs. Marshall set up his headquarters in the offices of the North Atlantic Division, leading to the tag word "Manhattan" which provided an effective cover, since Engineer Districts ordinarily took the names of their headquarter cities.[29]

The Manhattan Engineer District remained unique, however, not only in its mission, but in its status within the Corps of Engineers. Its District Engineer had the authority of a Division Engineer. He reported directly to the Chief of Engineers until September 1942 when Brigadier General Leslie R. Groves became the supervisor of the Manhattan Project above the District Engineer. Furthermore, unlike other Districts, the Manhattan Engineer District had no geographic boundaries. Its areas of concern spread across the United States and included Boston, New York, Chicago, St. Louis, Berkeley, California, Clinton, Tennessee, Hanford, Washington, and Los Alamos, New Mexico. The ultimate mission of the District remained a secret. From 1942 to 1944, it drew upon members of NAD for advice and paid for their services out of its funds, but none of these advisors knew the nature of the District's ultimate product.

The staff of the Manhattan Engineer District remained in New York City for some time until eventually moving to Tennessee. Even before the relocation, the District outgrew the offices at NAD headquarters at 270 Broadway. It took over an entire floor of a garment industry building at 261 Fifth Avenue. The District had several types of employees not found in other Districts: a scientific advisor, a medical officer familiar with radiation effects, and unit chiefs who oversaw electromagnetic process, plutonium piles, gaseous diffusion process, and heavy water development. A soldier armed with a rifle and bayonet stood guard outside the office at all times. He symbolized the secrecy and importance of the $2 billion project which helped to launch the nuclear age.[30]

V

A Variety of New Tasks

Division Engineers wore many hats during the war. They supervised military construction at home and abroad. They oversaw procurement of engineering supplies, obtained real estate for Army construction projects, and directed the Engineer personnel who operated and maintained gas, water and electrical utilities on the Army bases in the United States.

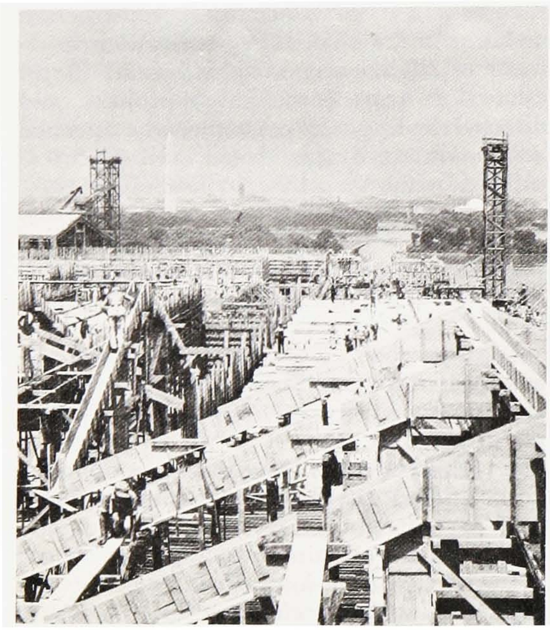
Price Adjustment and Renegotiation of Contracts

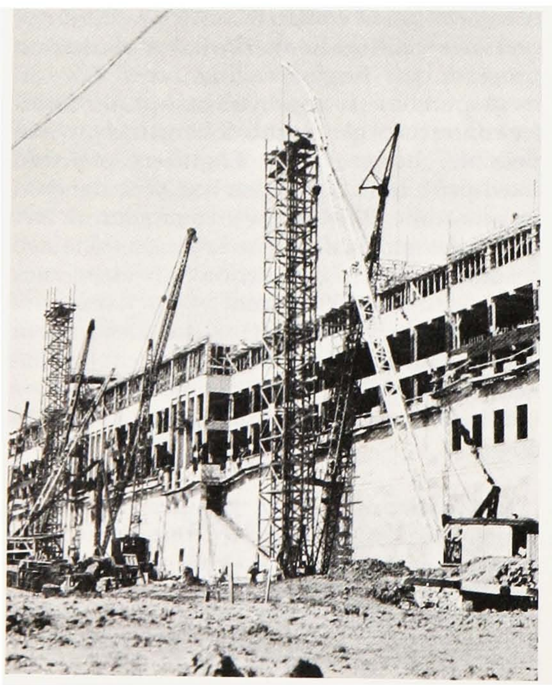
During the war years, the Engineers assumed responsibility for a construction program which cost $8.5 billion, exclusive of the Manhattan Project. This amounted to nearly one-third of all new construction in the United States. Division Offices played a major role in managing this enormous program. They sought to minimize waste and avoid excessive profits for contractors. To do this, the Engineers gave preference to fixed-price contracts. They also provided for review and renegotiation of contracts and for recapture of excessive profits. In the initial mobilization program, the Engineers, like other Government purchasers, approved cost-plus-a-fixed-fee contracts to get the job done quickly. When possible, however, the Engineers preferred fixed-price contracts which had been standard in peacetime. These kept greater control over both costs and profits. The Engineers obtained a much larger proportion of emergency construction — 50 percent — by fixed-price contracts, than the Quartermaster Department which had obtained only 20 percent in that manner. The Corps also used competitive bidding when possible to keep costs and prices down.

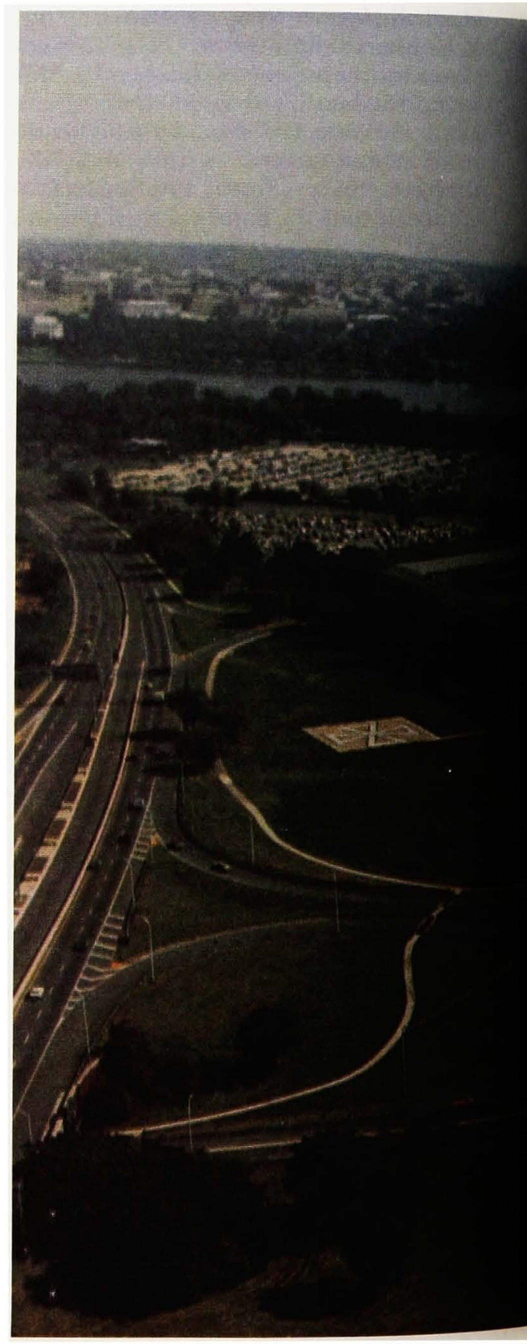
Renegotiation offered another manner in which the Corps sought to control excessive wartime profits by contractors. Although the great majority of construction expenditures were for actual construction costs, public attention focused on profits. In April 1942,

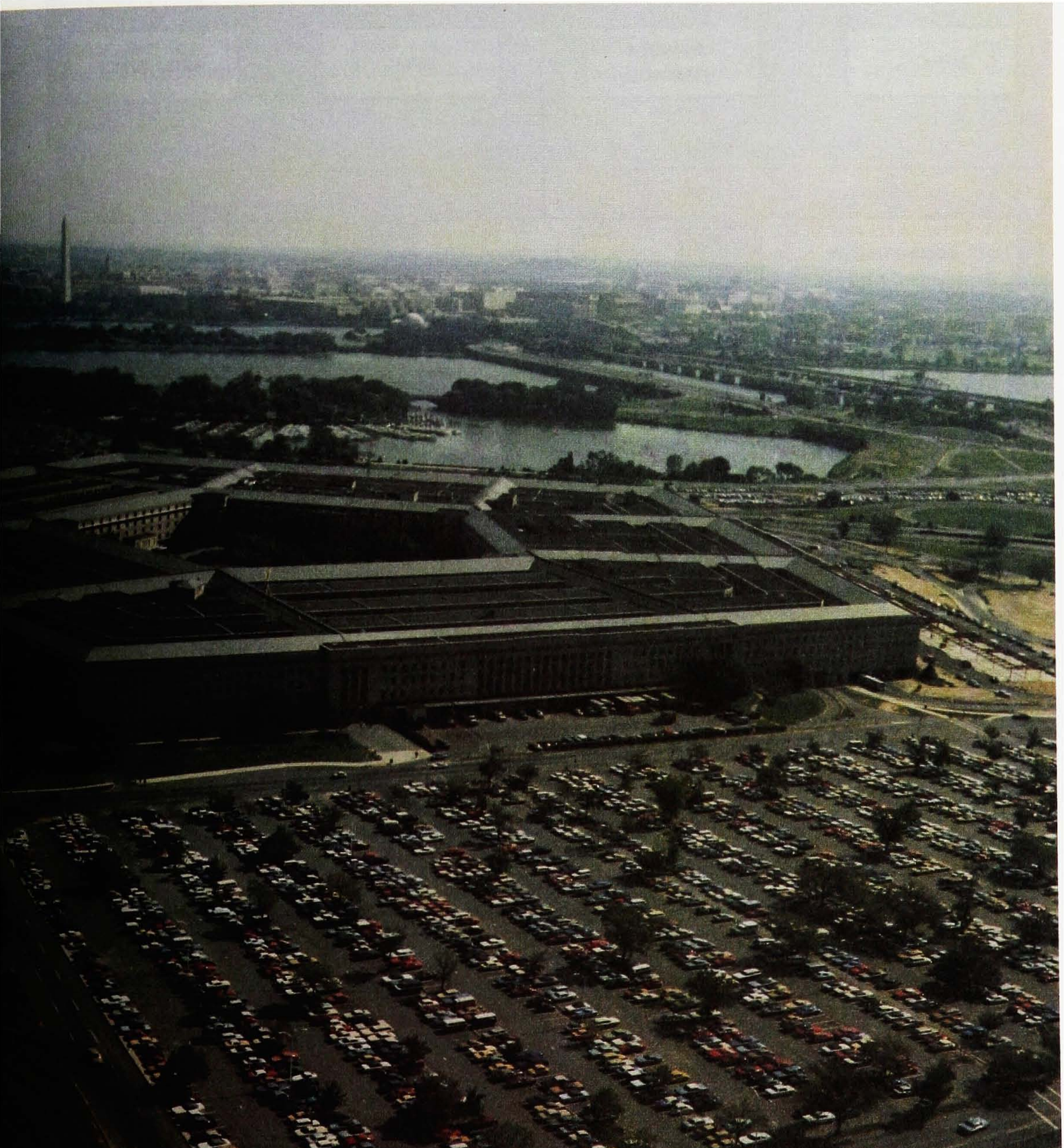
Construction of the Pentagon. Construction of the Pentagon was one of the Army Engineers' largest and most effective performances. A five-sided reinforced concrete office building designed to provide five million square feet of floor space for 40,000 employees, the Pentagon was to be the largest office building in the world. In the summer of 1941, plans were approved to erect the structures in Arlington, Virginia, at an estimated cost of $35 million. Under the direction of Captain Clarence Renshaw, a future North Atlantic Division Engineer, the 100-acre building went up rapidly in 1941 and 1942. At one point, 13,000 persons were working on the mammoth job. By the end of April 1942, after 2.5 million cubic yards of earth had been moved and 225,000 cubic yards of concrete had been poured, the first two sections of the building were completed on schedule. The first occupants moved into some one million square feet of office space that month.

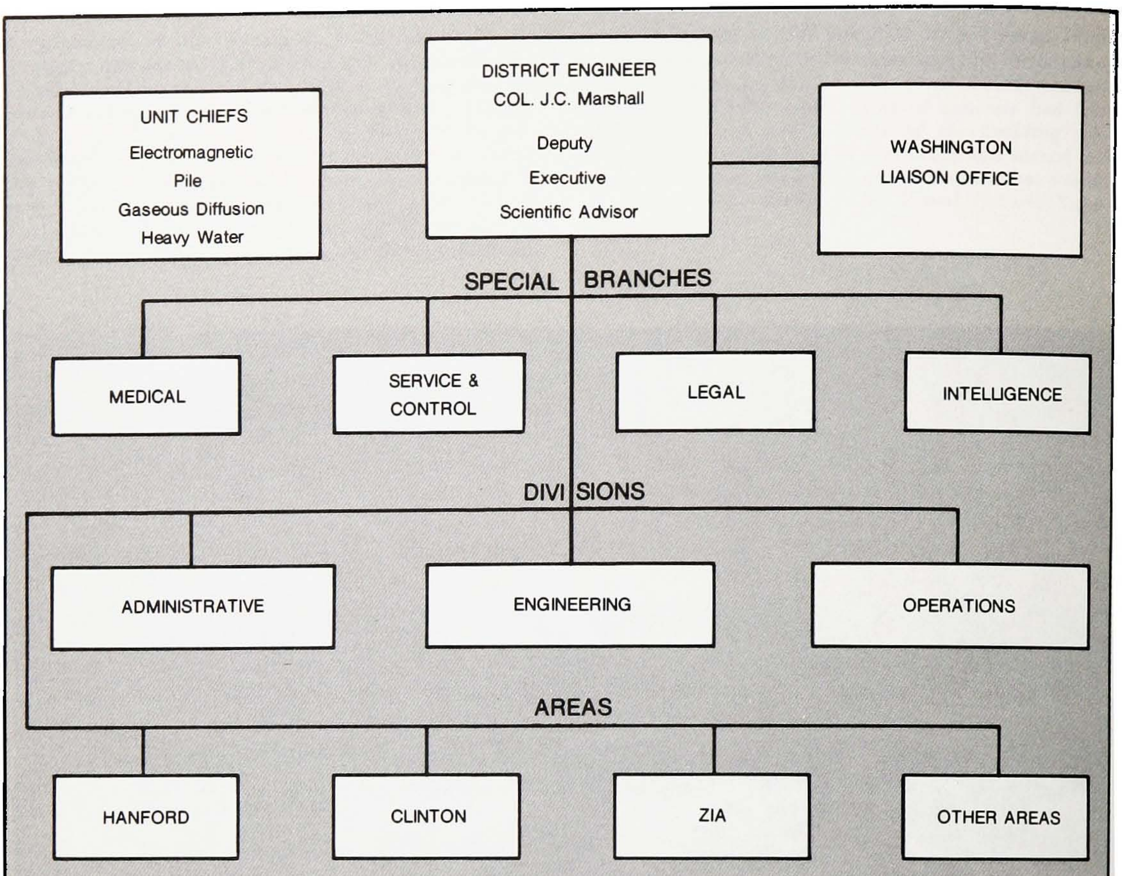
Source: U.S. Army Audio Visual Branch, Signal Corps.











MANHATTAN ENGINEER DISTRICT, APRIL 1943

Congress passed the first Renegotiation Act which required renegotiation clauses in all contracts over $100,000. Even before that, the Engineers had pioneered in profit control by experimenting with such clauses. In October 1942, the Chief of Engineers established a decentralized system of Price Adjustment Boards. There was one in each Division headquarters and another in the Office of the Chief of Engineers. By mid-1943, the Divisions renegotiated 90 percent of the Corps' cases of price adjustment.[31]

The Price Advisory Board in North Atlantic Division was composed of a number of special consultants. Attorneys, businessmen, accountants and comptrollers left their companies to work for the Corps during the war. When they selected a contractor for renegotiation, the Board members looked at his balance sheets. If they found the figures questionable, they made a detailed audit. If no evidence of excessive profits existed, the Board dropped the case. Otherwise, it tried to reach a voluntary settlement with the contractor. If he balked, however, the Board unilaterally determined the amount he had to refund. This money could be obtained by withholding government payments still due or by suing the contractor in court. In December 1944, NAD's Price Adjustment Section absorbed that of the New England Division and NAD's renegotiation authority then stretched from Maine to Delaware.[32]

The Corps' profit control procedures proved effective. Although three-quarters of the cases forwarded to the Engineers revealed no oversize earnings, the Corps by 1946 had recaptured $114 million from those firms found to have made excessive profits. Renegotiation of nearly 10,000 cases revealed 1,200 instances of excessive profits. They showed, in fact, that the cost-plus-a-fixed-fee

contracts yielded average profits of 2 per cent and fixed-price contracts produced average profits of 6 per cent. These represented a tribute to both the Engineers and the bulk of their contractors.[33]

Real Estate

Real estate acquisition and space management programs of the North Atlantic Division expanded along with the construction effort. Before the war, the Corps' land acquisition program had been almost totally decentralized. District Engineers or base commanders negotiated and concluded their own arrangements with landowners. These were, of course, subject to approval by Division Engineers and the Chief of Engineers. However, because of the enormity of the program in World War II, the Division Engineers received a much more important role in the real estate process.[34]

Centralization of authority came despite objections of Division Engineers including General Dunn. It resulted primarily from the efforts of Colonel John J. O'Brien, the Real Estate Chief of the Quartermaster General's Office, who in the consolidation of 1941-42 became the head of a similar office under the Chief of Engineers. He wanted to remodel the Engineers' structure to resemble the old zones of the Quartermaster's Department.

In 1941 and 1942, he accused District Engineers of paying overly generous prices for land, and he recommended transferring the real estate function from the Districts to the Divisions. General Dunn and other Division Engineers argued that District representatives knew the local situation better than regional administrators. In August, 1942, however, they accepted O'Brien's directive. For the remainder of the war, the Divisions ran the Corps' real estate program. In Fiscal 1942, the Corps acquired 5.3 million acres, an area almost the size of Connecticut.[35]

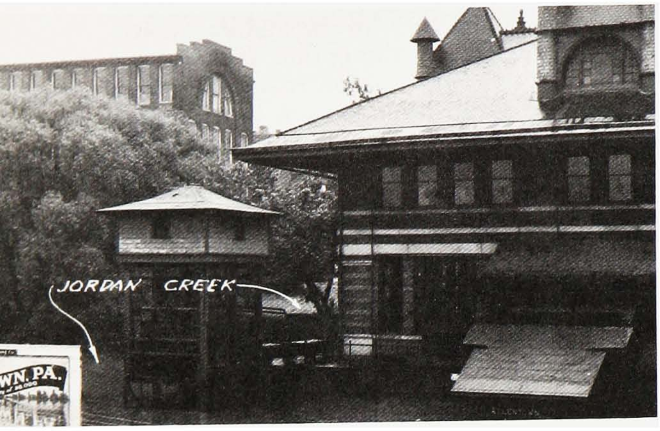
The North Atlantic Division's real estate officers managed an extensive land, office, and storage space program during the war. They leased thousands of square feet of space in offices, warehouses, and supply depots. They acquired public land or bought or leased private land for Army and Air Corps bases. Overseas, the State Department handled the real estate transactions with foreign landowners, but within the United States, NAD's real estate section grew in size and budget to perform this work. A long-time member of NAD's Real Estate Division recalled several major land acquisitions during those years. These included the expansion of Fort Dix and Camp Kilmer in New Jersey, Camp Shanks in Rockland County, New York, and Camp Drum in upstate New York. After the war, the Division liquidated many of these holdings during the demobilization and contraction of the Armed Forces. In 1947, the real estate function went back to the Districts and the Division resumed its purely supervisory role.[36]

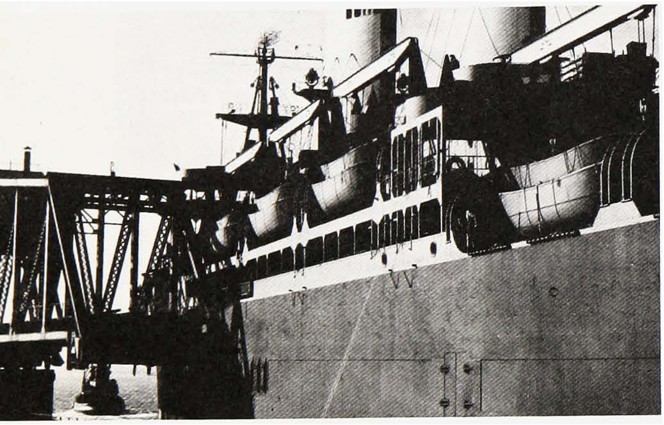
Army Service Commands

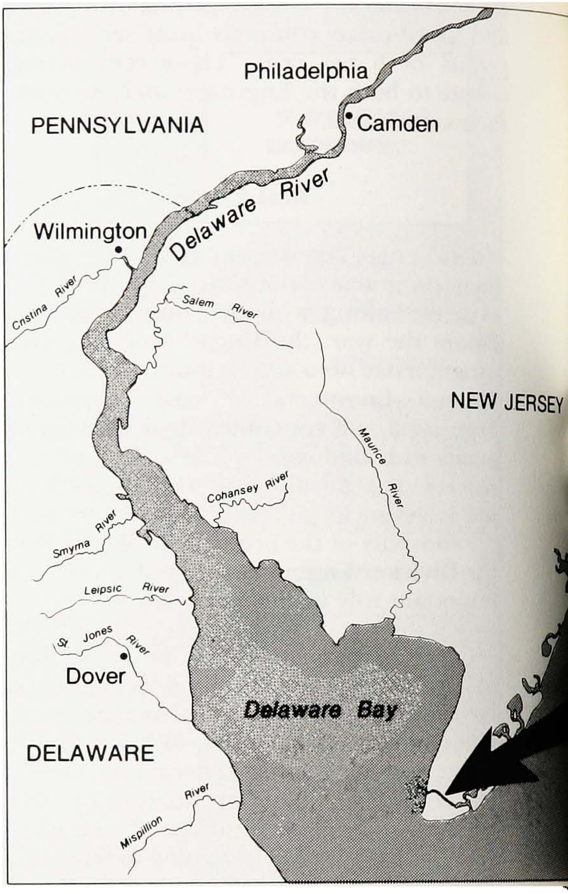
In addition to his other duties, the North Atlantic Division Engineer was also named Director of Real Estate, Repairs, and Utilities for the Second Army Service Command. This command included 50 different Army posts in New York, New Jersey and Delaware. As a member of the staff of the Service Commander for that area, the Division Engineer had responsibility for 3,200 Corps of Engineers employees at those posts. These workers maintained electricity, water purification, and gas generating facilities. Thus the Division Engineer wore two hats. In regard to military construction and river and harbor work, he served in the Corps of Engineers chain of command and reported to the Chief of Engineers. But as a result of the creation of the Services of Supply and the Army Service commands in 1942, the Division Engineer also reported to the Army Service Commander in his area in regard to the maintenance of utilities on the local Army posts. To assist him in this latter function, the North Atlantic Division Engineer had a staff of 45 persons in the Utilities Section at the NAD headquarters.[37]

Procurement

Responsibility for procurement of supplies needed for engineering construction projects at home and abroad was also added to the Division Engineer's duties during the war. The Engineers' procurement program was enormous. More than 27,000 different items were needed by the Army Engineers. These included construction machinery, bridge-building equipment, bulldozers, rollers,







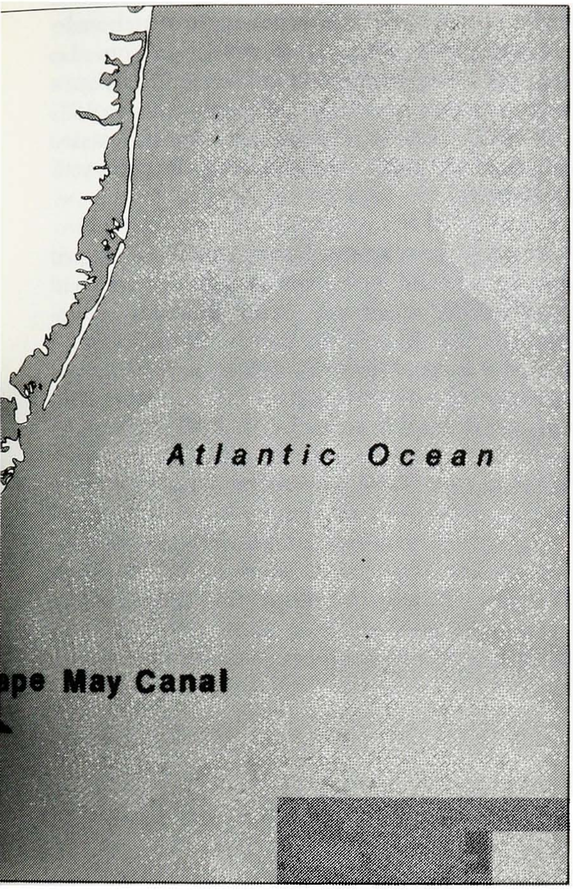
cranes, rock drillers, compressors, chain-saws, camouflage netting tools, lighting equipment, sandbags, nails, barbed wire, and much more. By the end of Fiscal Year 1942, Congress had appropriated more than $1.4 billion for procurement and replacement of Engineer materials.[38]

Depots

Because of his newly-assigned duty for procurement, the North Atlantic Division Engineer also received responsibility for supervision of the equipment storage facilities. Before being shipped to construction projects at home or abroad, the goods were housed temporarily in Engineer Depots, sub-Depots or warehouses in the Engineer Sections of the Army Service Forces (ASF) Depots. NAD supervised these Engineer facilities the same way it oversaw the Engineer Districts. It made certain that as Engineer units mobilized, they received their equipment and that they obtained replacements when they needed them. NAD also maintained an elaborate system of inventory control. By November 1943, the Division supervised Engineer Sections at ASF Depots in Schenectady, New York, and Belle Mead, New Jersey; an Engineer Depot at Albany, New York, and an Engineer sub-depot at North Adams, Massachusetts. By the following year, NAD also received responsibility for the Engineer Section of the ASF Depots at Fort Dix and Fort Eustis and at Richmond, Virginia; reserve warehouse space at Fort Ethan Allan, Vermont; and a holding and reconsignment point at Elmira, New York.[41]

Retrenchment

Beginning in 1944, NAD started to retrench and convert to peacetime status. Military construction reached its peak in 1942, and by early 1944 had shrunk to about the level recorded for October 1940. Procurement



Top Far Left. Allentown, Pennsylvania, During 1942 Flood.

Bottom Far Left. A Vessel Squeezes by a Swivel Bridge on the Hackensack River in New Jersey.
Source: The National Archives, Washington, DC.

Left. New Jersey Intracoastal Waterway and Cape May Canal.

diminished after late 1944 and the tonnage handled by Engineer depots dropped accordingly. Temporary wartime offices and Districts were eliminated. The Real Estate Division disposed of surplus holdings, cancelled leases on office space, and rented idle agricultural land to farmers. In April 1945, the Chief of Engineers reduced the number of Procurement Divisions from ten to six. This gave the North Atlantic Division supervision over a much larger area, including procurement offices in Boston, New York, Syracuse, Philadelphia, Baltimore, and Washington, D.C.[42]

VI
Civil Works

Civil works became secondary to military defense during the war. Although curtailed, they were not eliminated. The North Atlantic Division supervised a number of such projects. The focus of the civil works activity shifted. Flood control, which had been so important, languished during the war years. The Engineers completed a number of such projects partly through $1.5 million spent in south central New York state in 1943. But the war effort received top priority and new flood control projects had to wait. NAD's flood control section shrunk to one person during the war, an indication of its reduced importance.[43]

The most significant civil works activities during the war involved deepening the major rivers and harbors to accommodate the giant new transports, battleships, and aircraft carriers. The Army Engineers surveyed and provided cost estimates for deepening to 40 or 45 feet the approaches and anchorages in New York Harbor, Newark Bay, the Delaware River, and Baltimore Harbor. Between 1940 and 1942, U.S. hopper dredges removed more than 42 million cubic yards of material from the bottom of the Delaware River at a cost of over $4.5 million. In 1943, the New York District worked on projects totaling nearly $3 million for dredging the New York-New Jersey channels and anchorages.[44]

In 1943, major responsibility for procurement of Engineer supplies was shifted from the Districts to the Divisions. As an experiment, the North Atlantic Division became the first Division to be given a direct role in procurement. In April 1943, the Chief of Engineers ordered that all purchases previously made by procurement officers in the New York and Philadelphia Districts would be made at the Division level.

Two factors led to this regulation. One was the announced purpose of obtaining direct channels of responsibility and straight-line control to improve deliveries and increase production. The second concerned institutional survival. The Chief of Engineers apparently sought to use the river and harbor organization, which had many supporters in Congress, as a bulwark against an anticipated raid upon

its procurement activities and subsequently upon the Corps itself. The threat to the Corps' traditional function came from the successor to the Services of Supply, the Army Service Forces Headquarters. It came at a time when the Corps' domestic construction activity was diminishing and its procurement activity increasing. Reorganization within the Corps thus became a matter of increased efficiency and of protection of the organization's structural integrity.[39]

In November 1943, Division Engineers throughout the Corps assumed the active role in procurement that the North Atlantic Engineer had successfully performed on an experimental basis since April. The Office of the Chief of Engineers made procurement allocations directly to the Division Engineers. They in turn selected contractors, issued purchase orders, and then transferred further contract responsibility to the District Engineer nearest to the contractor's headquarters. The District Engineer expedited, inspected and concluded the transaction.

The North Atlantic Division became one of the major procurement areas of the Corps. During Fiscal 1943, NAD ordered goods worth $350 million, nearly one-quarter of the Corps' entire purchasing that year. The North Atlantic Division Engineer had been one of the first to favor moving procurement above the District level. Therefore, NAD became a test case, the only procurement contracting Division for most of 1943. Its procurement branch, headed by Colonel Charles Eaton, contained nearly 1,000 persons. These employees worked in the Division Office and in depots and liaison offices in the field. In addition to its regional purchasing, NAD had responsibility for purchasing all searchlights, camouflage equipment, firing devices, and water purification equipment for the entire Corps of Engineers. In terms of personnel and dollar volume, procurement became the major function of the North Atlantic Division in 1943 and 1944.[40]

The Army Engineers also worked on a number of canal projects. Most of these aided the war effort, and also proved beneficial to peacetime users. Because German submarines sunk large numbers of freighters and tankers along the East Coast, authorities saw the need for expanded use of intracoastal waterways. To facilitate the coastal movement of oil and other cargo, the Corps constructed the three-mile-long Cape May Canal. Army Engineers also kept the Chesapeake and Delaware Canal open despite major maritime accidents there in 1939 and 1942. Some 10 million tons of goods passed through the C&D Canal during the peak year of 1942.

During the war, the Government considered proposals for a deepened and widened intracoastal waterway from Boston, Massachusetts to Beaufort, South Carolina, and perhaps farther to Gulf Coast ports. Surveys made by the North Atlantic Division in 1942 estimated that it would cost $145 million to build a canal across central New Jersey between New York Bay and the Delaware River as part of that intracoastal waterway. Despite the Corps of Engineers' favorable recommendation on the basis of national defense, Congress failed to adopt the project. The submarine menace had eased by 1943 and shipping proceeded more normally on the sea lanes.[45]

VII
Conclusion

World War II had proven a global challenge. In the American military strategy of gradual advance against strongly-entrenched enemies, Army Engineers had to assist Armed Forces deployed around the world. In pursuing that strategy, the Corps built airfields, roads, ports, petroleum pipelines, army camps and cantonments, warehouses, hospitals, and dozens of other facilities. The experienced, decentralized, organization-in-being possessed by the Corps proved its worth. The Chief of Engineers applauded the job done by his agency in cooperation with the construction industry as providing, "the cornerstone of an enduring America."[46]

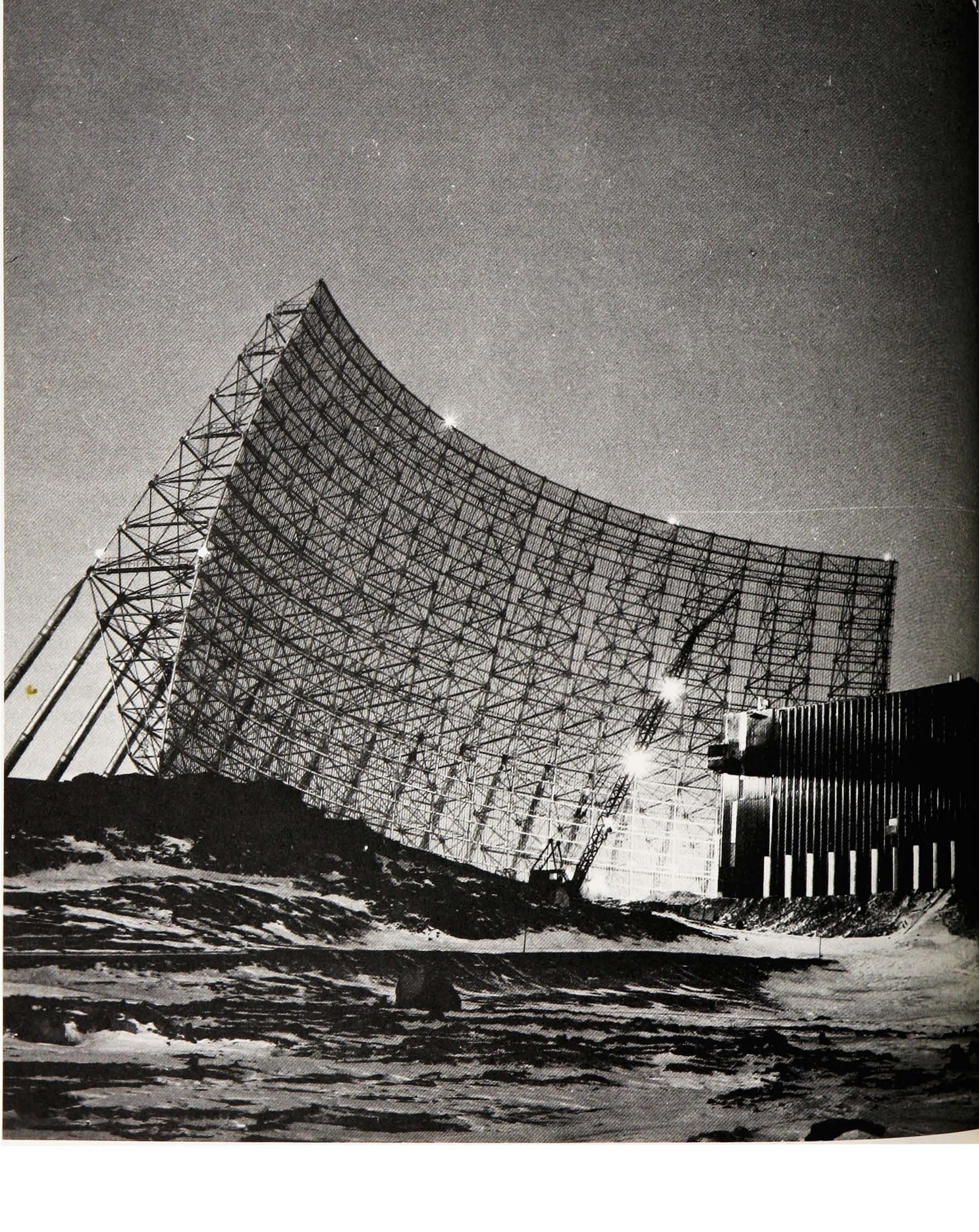
As an organization, the Corps of Engineers showed considerable strength and flexibility in dealing with the transition from peace to war. The Corps entered the conflict with able leadership, a proven administrative and opertional organization, and an established reputation. It had significant support in Congress, the Executive Branch, and in the local communities which it served. During the

numerous reorganizations which accompanied the expansion of the Army, these proved valuable assets in meeting the challenges posed by rival organizations. The Corps received the military construction mission from the Quartermaster General's Department. It warded off an attempt by the Service of Supply to remove its supervision over procurement of equipment for Engineering units. The Corps successfully adapted to the wartime transformation of the environment in which it operated. The Army Engineers not only maintained their traditional functions, but they performed a host of new missions and gained increased support as a result.

The North Atlantic Division similarly adapted to the wartime alterations. It shifted its primary functions from civil works to national defense. It handled a ten-fold increase in personnel in one year and it adjusted to several reorganizations in its jurisdictional area. By the time the war ended, NAD had supervised construction in New York, New Jersey, and Delaware, and abroad in Canada, Greenland, the Caribbean, North Africa, and the Middle East. It mobilized its forces to tackle new missions. It built Army camps and air bases. It managed real estate operations, procured engineering supplies, and supervised utility employees on 50 Army bases. The successful performance of these duties contributed to the Division's enhanced reputation.

The experience of the North Atlantic Division and the Corps of Engineers during the Second World War contributed to victory against the Axis Powers. It also helped to prepare the Army Engineers for the crucial role they would play in military defense at home and abroad in the subsequent era of the Cold War.

Typical BMEWS Surveillance Radar Antenna and Scanner Building, Thule, Greenland.



CHAPTER 5

Defending American Security in the Cold War Era, 1945-1975

I
Introduction

In the years after World War II, the United States found itself confronted by a powerfully-armed Soviet Union. The world entered the atomic age. It also experienced a period of rapid technological change. Electronics and computerization, new processes, new machines, and new materials led to increasingly complex weapons systems. All of the military construction programs of the Corps of Engineers in these years, from Distant Early Warning Systems to modern hospitals, proved more sophisticated than previous projects.

In support of the national defense, the Districts in the North Atlantic Division built facilities for both the Air Force, which had been created as a separate service in 1947, and for the Army. They constructed a string of air bases from Virginia to Canada and from Greenland to Morocco. They installed an extensive radar early-warning system against aerial attack along the northern perimeter of the Western Hemisphere. To protect the heavily-populated and industrial area of the country and the financial capital of the world, the Engineers built NIKE antiaircraft missile sites around the large metropolitan areas. They also erected an Intercontinental Ballistics Missile (ICBM) site at Plattsburgh, New York. During the military buildup for the Korean War, the Districts in the North Atlantic Division modernized cantonments, arsenals, and ordnance centers. The Engineers built new armories, reserve centers, and supply depots. Between the 1950s and the 1970s, they provided additional housing and other facilities on a number of Army bases. They also undertook major expansion of the facilities at the U.S. Military Academy at West Point and at Walter Reed Medical Center in Washington, D.C.

Military construction in the North Atlantic Division declined immediately after World War II, then grew and reached its peak in the early 1950s. In 1952, the annual expenditure reached $699 million. Subsequently, despite short-term deviations, military construction diminished both in dollar volume and in relationship to civil works. In 1960, for example, the dollar value of NAD's military construction program amounted to six times the civil works program. Six years later, the two programs equaled each other. By 1972, NAD's expenditures for military construction had dropped to $144 million.[1]

II
Changes in Organization

This cycle of fluctuating defense spending led to major reorganizations in the territorial jurisdiction of the North Atlantic Division. First, the Corps adapted its wartime Division/District structure to peacetime needs. Then, as the Cold War emerged, the Chief of Engineers created new units. NAD received responsibility for new Districts in Canada, Greenland, Iceland, the Azores, Bermuda, Greece, Turkey and North Africa.

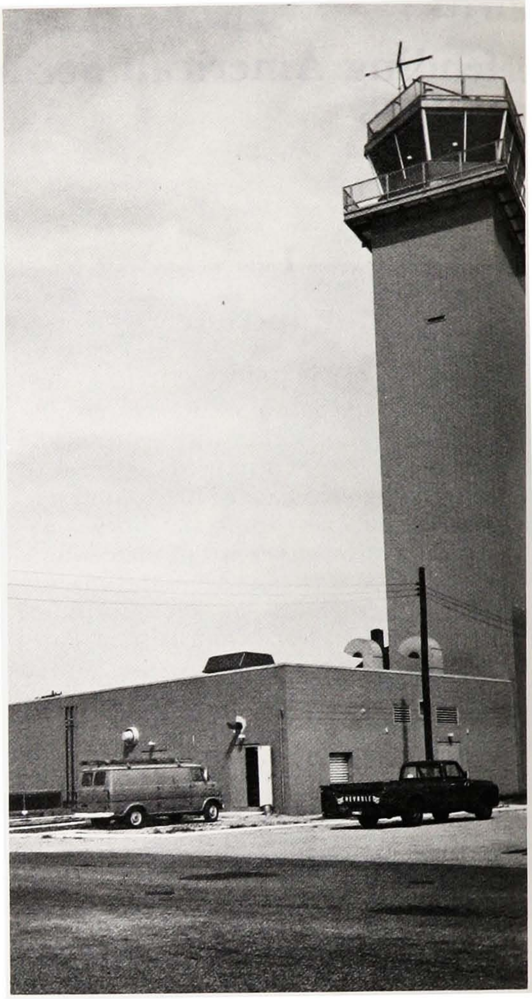
Following World War II, the Armed Forces of the United States demobilized rapidly. Reorganization of the North Atlantic Division accompanied the demobilization. In the spring of 1946, military supply procurement functions were decentralized from Division to District level. A few months later, the Engineer Sections of various Army Depots were transferred from NAD to the Office of the Chief of Engineers. In the fall of 1946, the Boston and Providence Districts of the New England Division were terminated. The New England Division became an operating Division, without Districts. From its headquarters in Boston, it directed operations from Maine to Connecticut. In 1970, the Chief of Engineers transferred the military responsibilities of the New England Division to the New York District of NAD. The North Atlantic Division

absorbed the Middle Atlantic Division in the fall of 1946.[2]

Escalating tensions between the United States and the Soviet Union reached a new high in 1947, a point which has been called the beginning of the Cold War. The threat of hostilities resulted in new assignments for the North Atlantic Division. In March 1947, President Harry Truman called for the containment of Communist expansion and pledged economic and military assistance to Greece and Turkey. Congress approved the Truman Doctrine and appropriated $400 million in 1947 for Greek-Turkish aid. Consequently, the Chief of Engineers created a Grecian Engineer District under the North Atlantic Division. The new unit helped rebuild port facilities, the Corinth Canal, and other projects until it was terminated in 1949.

The outbreak of the Korean War on June 25, 1950, led to expanded U.S. defense appropriations.[3] In the burgeoning military construction program, the North Atlantic Division received responsibilities in Canada, the Middle East, and the northern and southern Atlantic Ocean areas. In 1950, the Chief of Engineers gave NAD supervision over a U.S. Engineer Group established in Ankara, Turkey. That same year, he establishd a Middle East District in Tripoli, Libya, to supervise military construction in North Africa and the Middle East. It too was placed under NAD's jurisdiction. In 1951, three new Districts came under NAD. The East Atlantic District built air bases in the Azores and western Mediterranean. The Northeast District constructed a major air base at Thule (pronounced TOOL-EE) in northern Greenland. And the North American, later designated the Atlantic District, supervised construction in Canada and Bermuda.

Because of the proliferation of military construction projects, the Chief of Engineers created the East Ocean Division in November 1951 to oversee work outside the United States. Four months later, the Mediterranean Division was established to help lighten the workload of the new East Ocean Division. Eventually, in January 1955, North Atlantic Division absorbed the East Ocean Division. Three years later, NAD began to provide rear echelon support for the Mediterranean Division. Thus, at the peak of its workload, NAD had a military construction responsibility which stretched halfway around the world.[4]



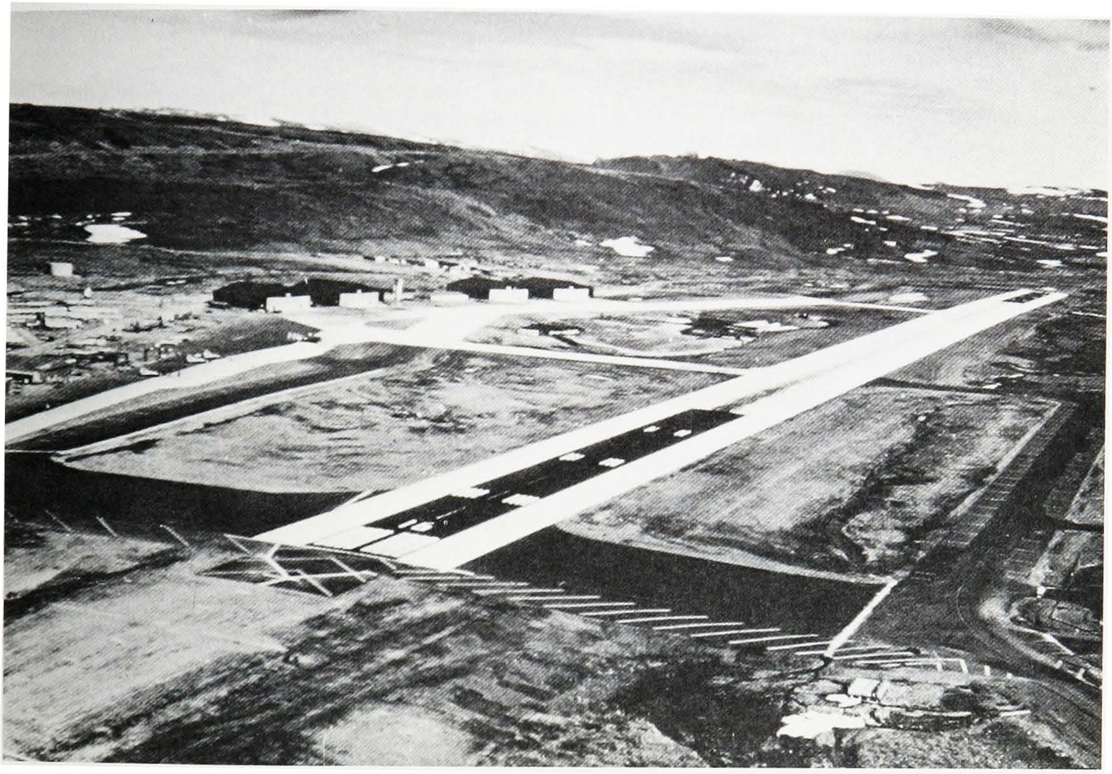
III

Air Force Construction

Many of the most challenging military construction projects undertaken by the North Atlantic Division served the U.S. Air Force. Sophisticated facilities were designed and built so that the Air Force could retaliate from widely-scattered positions against any threat to American security. In the 1950s, the Air Force grew to a strength of 137 wings. NAD built new bases with longer runways and larger hangars to handle the big new bombers — B-36s, B-47s, and eventually B-52s — of the Strategic Air Command (SAC).

Left. Control Tower at McGuire Air Force Base, New Jersey.

Below. Runway at Thule Air Force Base, Greenland.



Thule Air Force Base

Undoubtedly, the most exciting and challenging of these assignments came in the construction of Thule Air Force Base north of the Arctic Circle in Greenland. At first, the proposal for Thule sounded almost impossible. In December 1950, the Secretary of the Air Force told the Chief of Engineers that he wanted a major bomber base constructed in northern Greenland — and he wanted planes to be able to land there within a year. This meant that the Engineers would have to locate a site, design the base, assemble thousands of tons of material and thousands of workmen, transport them to Greenland, and then build a bomber base which would have runways two miles long. Furthermore, the Engineers would have to build the base — at least the first operable part of it — within a three-month construction season in the arctic summer. Undaunted, the Chief of Engineers agreed, and the secret project—code-named BLUE JAY—began at once.[5]

The first task was to pick a site and to select a team to run the project. After a survey, the Engineers chose Thule on the west coast of northern Greenland, 800 miles from the North Pole and 2,800 miles from Moscow. Colonel Clarence Renshaw, who had been project engineer for construction of the Pentagon, was selected to head the work at Thule. He established the Northeast District, operating under NAD's supervision. Division Engineer Colonel Frederick F. Frech assisted the Thule project by working with the other services to ensure cooperation and proper coordination of supplies. Because of the lack of immediately-available facilities in New York Harbor,

Colonel Renshaw decided to use the port of Norfolk as the assembly and shipping point for material. NAD helped secure the facilities. The first of 90 ships left Norfolk on June 5, 1951 loaded with men and equipment. Breaking through the ice, they arrived at North Star Bay near Thule a month later.

Work proceeded during the continuously bright days and nights in the arctic summer. By mid-September, Colonel Frech reported to Washington that everything planned for 1951 would be accomplished before the onset of winter. Barracks were ready for occupancy, other buildings were far along. The runway, completed to 7,000 feet, had its first coat of asphalt and the first plane, a C-124, used it on September 11. Permafrost proved to be the greatest single construction problem at Thule. Located from one to five feet below the surface and extending to depths of at least 1,000 feet, permafrost could be partially melted by heat from the buildings. Thawing caused foundations to settle, and this, in turn, strained the building's structure. To minimize this, contractors erected buildings on pads of insulating materials. Sometimes they put the buildings on short piers which allowed cold air to pass underneath, diffusing the heat. The Engineers overcame the permafrost problem and completed the base at Thule which eventually included two miles of runways, nine miles of taxiways, six B-36 hangars, and living accommodations for 5,000 men. Through a remarkable effort, the Engineers met their deadline at Thule. They broke one of the world's great frontiers and brought large-scale construction to the Arctic. After inspecting the base in September 1951, the Chief of Engineers called the feat "the biggest job in Army engineering history."[6]

General View of BMEWS Technical Site, Thule Air Force Base, Greenland.

Early Warning Systems

During the next decade, under the supervision of the East Ocean District and, after 1955, the North Atlantic Division, Army Engineers built an early warning system in Greenland.

The Distant Early Warning (DEW) Line stations were constructed in 1958. The builders of these arctic outpost radar stations faced enormous problems of snow accumulation. To overcome the effects of snow fall and of unequal footing settlement on the ice cap, the Engineers took special care with the DEW stations. Each station consisted of a two-story building surmounted with a two-story radar tower. The Engineers elevated each building above the snow surface on eight pairs of columns. To each pair of columns, they attached two 350-ton hydraulic jacks. Then, as snow accumulated and the ice cap sank, the Engineers raised and leveled the structure using the giant hydraulic jacks.

The Engineers also built a Ballistic Missile Early Warning System (BMEWS) station at Thule. Completed in 1959 at a cost of $100 million, it included four, high surveillance, radar "bill board" antennas. Each of these screens measured 400 by 165 feet, larger than a football field. Since the snow-filled screens reacted like airfoils in a high wind and had to withstand arctic gusts of up to 150 miles per hour, the Engineers took great pains to anchor the footing adequately. As constructed, BMEWS provided a system for detecting the launching of a missile from Soviet Union. It could then plot the missile's course and speed, predict its point of impact, and provide some warning.

Camp Century: The City Under the Ice

Perhaps the most novel engineering feat in Greenland was the construction of Camp Century, one of the most extraordinary military installations in the world. Built between 1958 and 1961, it served as a research base and a place to test semi-portable nuclear power plants which could be assembled in the field. To protect the station against the severe polar storms and to avoid the problem of snow build-up which could bury such structures in two years, the Army Engineers decided to build the Polar Experimental Station below the surface of the ice-cap. The underground, prefabricated nuclear power plant produced 1,500 kw of power, generated 1,000,000 B.T.U. of low pressure steam per hour, and provided all the heat and power needed by the camp. Located more than 100 miles from Thule, Camp Century served as the underground home for 100 scientists and soldiers conducting year-round polar research in defiance of extreme surface temperatures and winds. The experiment lasted for nearly a decade until the camp was decommissioned in 1967.[7]

NAD in the Arctic

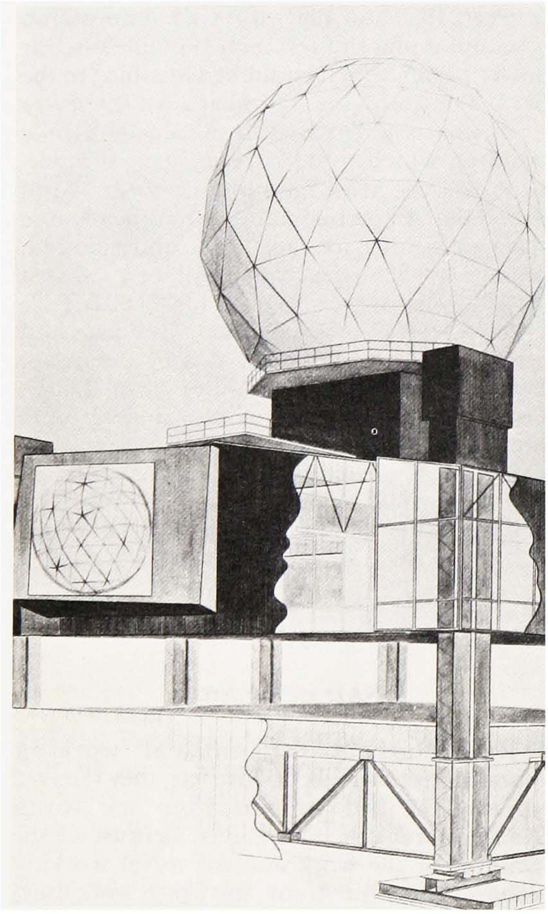
Regardless of the unusual working conditions of the arctic Districts, they received supervision and support from the North Atlantic and other Divisions. Because of the priority of the work and the novel working conditions in the Arctic, the Corps sometimes departed from traditional practice. Districts received additional autonomy and the Engineers sometimes took procedural short cuts. "With the weather problem and the short building season, we had to work fast," one NAD employee recalled. "Sometimes, we started to build a foundation for a building before the super-structure had been fully designed."[8] Furthermore, the comptroller of the Northeast District performed the normally divided functions of both approving and dispersing funds. This was allowed in order to have Thule Air Force Base operational in a single building season.[9]

Top Left. Artist's Conception of Composite Building at Ice Gap Station.

Top Right. Aerial View of Camp Tuto, Greenland.

Bottom Left. Caterpillar Swing Train from Camp Tuto to Camp Century.

Bottom Right. Construction of 40-Foot Wonder Arches at Camp Century.
Source: Official U.S. Army Photograph



Monitoring the work of the District through egular reports and periodic inspections, the)ivision provided assistance and control. To liminate a blockage on construction of the Tracking and Telemetry Facility at Thule, NAD put pressure upon the manufacturer to meet the agreed-upon construction schedule.[10] General Thomas Lipscomb, North Atlantic Division Engineer, took a personal hand and negotiated the main contract for $102 million for the BMEWS project.[11]

An inspection team from NAD, led by the Assistant Division Engineer, visited Greenland in September 1956. Although they found the quality of construction and the administration of the area office at Thule to be excellent, the team did discover some problem areas. They noted that the unit cost per square foot at the Base Bulk Supply Warehouse far exceeded that at the Heated Vehicle Storage and Auto Shop, and they made recommendations to alleviate this discrepancy. They also streamlined procedures to ensure better coordination of information between the jobsite contractor and the Area Engineer.[12]

Other NAD Air Force Projects Overseas

The North Atlantic and East Ocean Divisions also built Air Force bases in Iceland, Canada, Bermuda, the Azores and Morocco. Some projects were extremely large. The air base in French Morocco cost $300 million. In the Portugese Azores, NAD took over a British air base project and constructed a major facility at Lajes Field to refuel SAC bombers. Between 1951 and 1963, NAD spent $180 million expanding a base in the subarctic area at Goose Bay, Labrador in Canada, so that it could handle the new SAC planes.

In this work, NAD coordinated activity with the Air Force and supervised construction. Division Engineers reported on progress and explained any changes in the schedule or the occupancy dates. The Division pressed to get the work done on time. In the construction of family housing units for the Goose Bay Air Force Base, for example, the head of NAD's Engineering Division offered suggestions for better weather-proofing. In addition, the Division Engineer, Brigadier General David Parker, prodded the District Engineer to speed up the contractor. "I would like to have a periodic, personal report from you," General Parker said, "as to how the erection program is coming and as to steps which are being taken to achieve the earliest possible completion dates for individual units."[13]

NAD's Eastern Ocean District, which had responsibility for much of this overseas work, received high praise from the Chief of Engineers. Between its formation in 1954 and this termination in 1963, the District handled more than $1.3 billion of military defense projects outside the United States. Lieutenant General W. K. Wilson, Jr., the Chief of Engineers, complimented the District at its closure for its accomplishments, especially the innovative work in the arctic regions. "These unique designs and construction methods," he said, "have . . become a monument to the Corps' ability to accomplish next to the impossible."[14]

Air Force Construction in the U.S.

During the postwar years, NAD supervised construction for the Air Force within the United States as well as overseas. This work was handled through existing Districts with headquarters in New York, Philadelphia and Baltimore. The Engineers built air bases, radar stations, and missile facilities.

Of the air bases, the largest was at Plattsburgh, New York, where the New York District converted an old Army training camp into a major SAC base. "We started from scratch," one veteran of the project remembered. "We had a lot of problems because it was the District's first SAC base and because much of the area was a swamp and had to be drained. But we did it."[15] The Engineers also modernized a number of existing bases to handle the new jet fighters and bombers. These included Sampson AFB; McGuire AFB, Dover AFB, Griffiss AFB, Andrews AFB; and several smaller airfields.

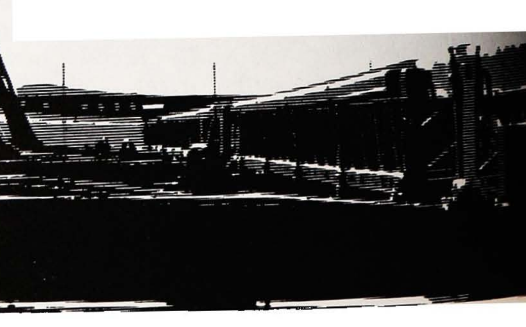
NAD's Districts also built a string of unmanned Aircraft Warning and Radar Stations in the Adirondack Mountains and other remote areas of the Northeast. As a result of the Engineers' work, a number of larger radar stations dotted the countryside from New York to Virginia.[16]

With the coming of the missile age, NAD supervised construction for the Air Force of a

Left. NIKE-HERCULES Missile Ready for Launch.

Below. NIKE-HERCULES Missile Site, Dawsonville, Maryland.

Bottom Right. NIKE-HERCULES Missile at Launch.
Source: U.S. Army Audio Visual Branch.



number of launch sites in the 1950s and 1960s. The first Air Force missile, a medium-range, anti-aircraft weapon called BOMARC, could intercept enemy bombers up to 400 miles away. BOMARC missile sites included steel-protected launchers at ground level and storage facilities below the surface. Beginning in 1958, the Engineers erected these sites at Westhampton, McGuire AFB, Niagara Falls, and elsewhere to protect major urban areas and SAC bases in the NAD region.

NAD also became involved in the early stages of America's Intercontinental Ballistic Missile (ICBM) Program. In 1960, the New York District began to build thirteen silos for Atlas ICBMs near Plattsburgh, N.Y. Constructing the underground facilities was an engineering feat. Each silo measured 180-feet deep and 30 feet in diameter. Each was protected by a heavy concrete cover and trap door which could withstand earthquakes and even a near miss by a nuclear weapon. An elevator system raised the missile to its firing position. A special vessel constructed underground contained the liquid oxygen which had to be added to the kerosene fuel. NAD and other Divisions had pursued such construction for only about six months when the Chief of Engineers established a specialized central construction agency to construct all ICBM sites throughout the country.[17]

Army Construction

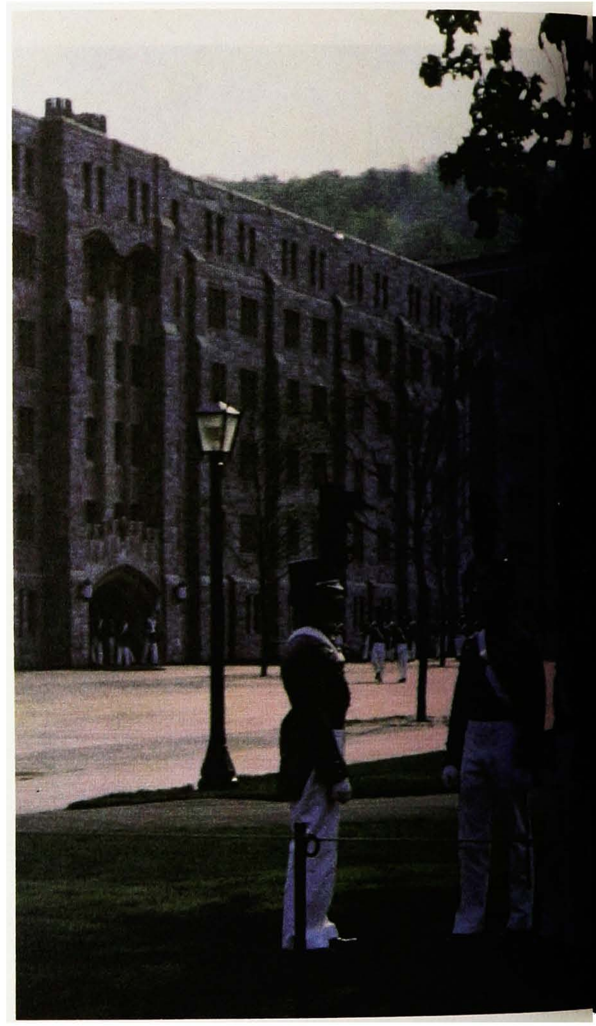
During the Cold War era, Army and Air Force construction work roughly balanced each other in NAD's military construction mission. The ratio did not remain constant, however. In the 1950s, Air Force work dominated NAD's efforts. In the 1960s and 1970s, Army construction became the Division's prime military concern.

In the demobilization immediately following Work War II, NAD confined its Districts' military construction primarily to Veterans' Administration hospitals. The Engineers built or modernized veterans' hospitals at Valley Forge, Pennsylvania; Fort Hamilton, and Manhattan in New York City; Peekskill and Albany in upstate New York; and Orange, New Jersey.

The onset of the Cold War and the outbreak of the Korean War led to expanded facilities for

recruiting, training, and maintaining a greatly increased Army. NAD's Real Estate Division leased storefront locations for the Defense Department's new recruiting centers. Formerly these had been in U.S. Post Offices. The expansion of the Army Reserves in the 1950s led to leasing and construction of urban and suburban facilities for these units. NAD's Districts converted many automobile showrooms to Reserve Centers. They were useful to the Reserves because of their high ceilings and garage facilities. The Engineers also built a number of 1,000-man armories for the Reserves.[18] They also constructed the giant Tobyhanna, Pennsylvania Signal Corps Depot and a number of other depots and arsenals.

NAD supervised a major expansion of Army housing in the 1950s. During the Korean War, it oversaw the improvement of barracks at Fort Dix, N.J., Fort Eustis, Va. and other training facilities. In following years, its Districts built hospitals, cafeterias, classrooms, warehouses, and infirmaries on numerous Army posts. In the 1950s, Wherry-Capehart legislation provided for much new base housing. Previously most military construction had been financed directly by the Government. But the Wherry-Capehart legislation provided for Government insurance to support financing through banks, savings and loan associations and insurance companies. Thus, contractors had to arrange financing as well as construction. NAD took an active role in clarifying procedures and keeping its Districts informed of the complex new program. In 1956 alone, NAD had more than 3,600 Capehart Housing units worth $135 million scheduled for construction in its area.[19]



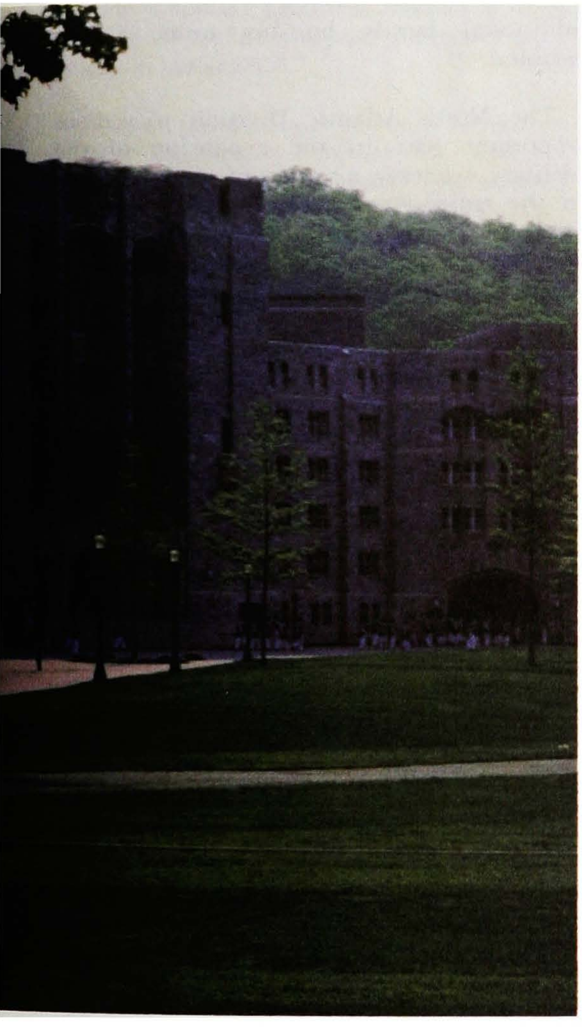
In support of the deployment of antiaircraft weapons around the major cities in the North Atlantic Region, NAD performed significant work in the 1940s and 1950s. Some antiaircraft gun sites had been installed during and after World War II, but the major new program involved the NIKE, a short-range, surface-to-air missile. The weapon went through a series of developments with the various generations named NIKE-AJAX, NIKE-HERCULES, and NIKE-ZEUS. Since the missile had a relatively short range — 20 miles in the case of the NIKE-AJAX — officials considered it an extension of antiaircraft artillery. Thus it came under Army rather than Air Force jurisdiction. Rings of NIKE sites encircled Boston, Buffalo, New York, Philadelphia, Washington, Baltimore and Norfolk. NAD's Districts acquired the suburban real estate. Beginning in 1953, they constructed the NIKE batteries. As the missile moved through successive generations, the Army Engineers redesigned the launch boxes. In the later stages, they put the structures underground.[20]

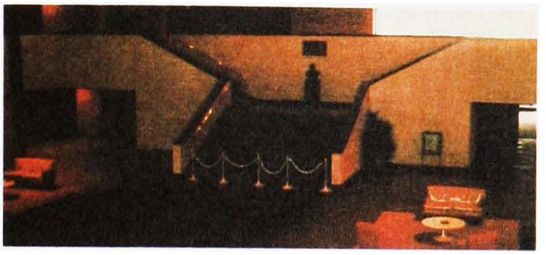
Below. Washington Hall Barracks Complex, U.S. Military Academy, West Point, New York.

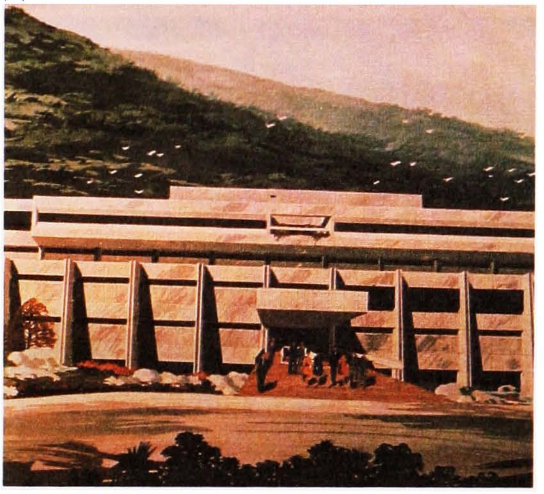
Top Right. Lounge Area in Eisenhower Hall, U.S. Military Academy, West Point, New York.

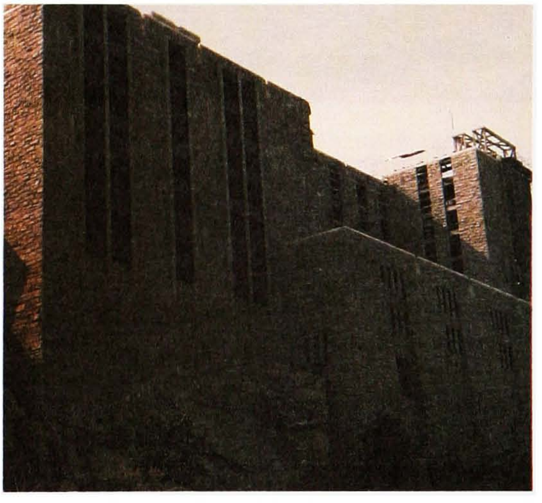
Center Right. Hospital, U.S. Military Academy, West Point, New York.

Bottom Right. Science Building, U.S. Military Academy, West Point, New York.









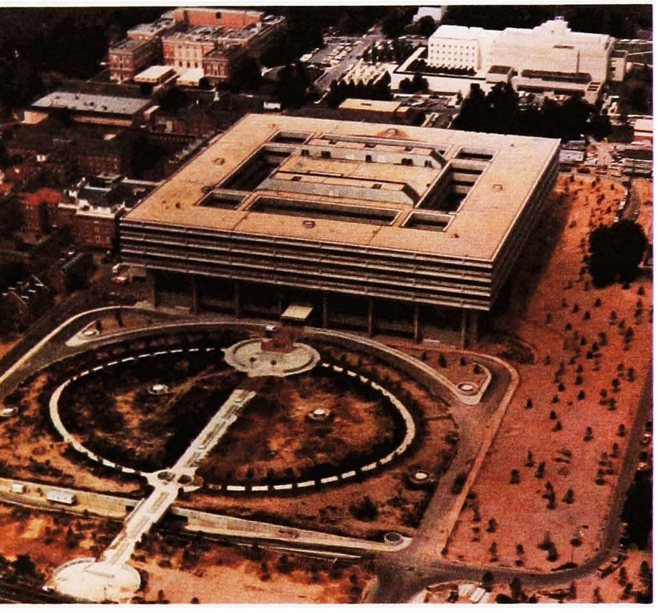
West Point Expansion

Two of the single most extensive and innovative military construction projects supervised by the North Atlantic Division were the expansion of the U.S. Military Academy and the modernization of Walter Reed Army Hospital.

In 1964, Congress authorized an expansion of the Corps of Cadets from 2,500 to 4,400 and authorized $170 million for new construction at West Point. During the next dozen years, the New York District, under NAD's supervision, built several structures. These included a dining hall and barracks complex, a gymnasium, a new classrom building,

Top. Walter Reed Army Medical Center Under Construction in 1970s.

Bottom. Architect's Rendering of Walter Reed Army Medical Center, Washington, DC, in 1970s.



additional family housing units, and a hospital.

The North Atlantic Division played an important part in the expansion of the Military Academy, a project of special interest to the entire Army. Representatives of the Division became directly involved in the selection of contractors. They accompanied District officers in their meetings with the architect-engineers and the constructors. They toured the site as observers and inspectors. This close supervisory role meant that NAD maintained constant contact with the project. For example, the Division recommended that the prime contractor on the Washington Hall Complex avoid leaving decisions to his subcontractors. As the Chief of NAD's Construction-Operations Division put it in 1966, "On a project of this nature it is considered that the prime contractor take

personal charge of administration by his staff. . . ."[21] Because of the extreme interest in the Academy project by the Army Officer Corps, a number of instances occurred when people bypassed the District and Vision and went directly to Washington. Such departures from the chain of command seemed unwise to General Parker, Division Engineer during the initial stage of construction. In retrospect, he concluded that it would have been preferable to create a special Engineer District at West Point for the specific purpose of executing the expansion program.[22]

Although rapid inflation thwarted Engineer efforts to keep within original cost estimates, the project won high praise. To counter construction costs which soared at up to 15 per cent a year, the Division revised its biddng procedures in an attempt to increase competition and reduce costs. This proved of little avail. Nevertheless, several buildings won awards from the engineering and architectural community.[23]

Walter Reed Army Medical Center

The other major Army project under NAD's jurisdiction was the modernization of the Walter Reed Medical Center. Work began on the 1,200-bed hospital in 1972. Estimated at $110 million, the project sought to make Walter Reed complex the most modern medical facility in the world.

North Atlantic Division Engineers paid close attention to the project, one of the largest that NAD had supervised. They monitored progress and made a number of constructive suggestions for cost-savings and for avoiding undue delays.[24]

Other Army Projects

In the late 1960s, the Department of Defense approved a number of projects in the United States in support of the American military effort in Southeast Asia. In August 1965, Congress authorized funds for expanding training facilities. Engineers built a night-vision and infra-red laboratory at Fort Belvoir. They put up new barracks at A. P. Hill Station cantonment, Fort Monmouth and Fort Dix. They erected Officers Candidate Schools and other buildings at Fort Eustis and Aberdeen. Additions were made to Picatinny Arsenal and Letterkenny Army Depot. NAD's FY 1966 programs for work in support of the Southeast Asia effort totaled $10 million.[25]

The Engineers supervised a wide variety of construction projects for the Army in the 1960s and 1970s. They modernized barracks, emphasizing privacy and comfort, for the new Volunteer Army Program. Near the District of Columbia, they built the Harry Diamond Weapons Laboratory. This $40 million complex became the most modern weapons testing facility in the world. The Corps also converted the Radford Army Ammunition Plant in Virginia into an automated single-base propellant manufacturing facility. In most Army projects, the Engineers installed equipment for pollution abatement which became a matter of great concern to the Corps as well as the Nation in the 1970s. New facilities aimed at reducing smoke and liquid wastes were included. The Engineers also improved sewage treatment plants at Army bases.

V

Changes in NAD Procedures

Although the North Atlantic Division maintained many of its traditional procedures, it also underwent a number of changes during the decades which followed World War II.

The cycle of demobilization and remobilization affected the size of functions of the NAD headquarters. That office shrank from nearly 2,500 employees in the war years, to fewer than 200 persons by 1947. By 1952, it had increased to 250 and remained close to that for the next quarter century. Given the dramatic changes in mission in that period, this can be seen as a tribute to the flexibility and effectiveness of the NAD staff.[26]

Some two dozen officers served in the critical post of Division Engineer during the three decades from 1945 to 1975. The career of Brigadier General Clarence Renshaw illustrates the qualities which served the Division so well.

Biographical Sketch

Brigadier General Clarence Renshaw

Division Engineer, 1955-1959

Clarence Renshaw had a distinguished military career. A 1929 graduate of the U.S. Military Academy, he also received a Bachelor of Science Degree in Building Construction and a Master of Science Degree in Business and Engineering Administration from the Massachusetts Institute of Technology.

Military Construction was General Renshaw's speciality throughout his service in the Army. Commissioned in the Quartermaster Corps, he worked on Army construction projects in Washington, D.C., Panama, New York, and Norfolk. He was the Constructing Quartermaster for the Pentagon in 1941 when military construction was transferred from the Quartermaster to the Corps of Engineers.

Following the completion of the Pentagon in 1942, General Renshaw served as District Engineer at Washington, D.C. and then Philadelphia. He commanded the New York District from 1945-1946, and then served as District Engineer at Manila in the Philippines for three years while the harbors, ports, and military bases there were being reconstructed. When he returned to the United States, he served as Chief of the Operations Division and then Director of Air Force Installations in the Office of the Chief of Engineers.

In 1951, he directed construction of the Strategic Command's first major arctic base, located at Thule, Greenland. He organized the Northeast Engineer District in NAD, set the priorities, obtained the supplies, and completed the first year's objective despite arctic weather conditions. Returning to the United States, he was graduated from the Industrial College of the Armed Forces. From 1952 to 1954, he was District Engineer at Okinawa.

General Renshaw became Assistant to the North Atlantic Division Engineer in 1954. He was appointed Division Engineer in 1955 and served in that capacity until 1959. He was then appointed Assistant Chief of Engineers for Military Construction. When he retired from the service, General Renshaw became a consulting engineer and vice-president of the New York engineering firm of Frederick R. Harris, Inc.[27]

The primary responsibility of NAD continued to be the supervision of the activities of its Engineer Districts. As the *General Regulations* of 1956 put it, the Division Engineer "directs, supervises, and manages the activities of the division office staff and the operation of subordinate field offices in accomplishing the assigned missions."[28]

A major responsibility of the Division remained coordination of the Engineers' work in the North Atlantic Region. This meant obtaining a good working relationship among different Branches of the Armed Forces, among the various Engineer Districts, and between

central direction and local execution. Sometimes this meant working out knotty scheduling problems to ensure that material for overseas construction projects would move quickly through port facilities and across the ocean. Division Engineers developed fine working relationships with Naval and Air Force officers and with civil authorities in their regions. To encourage that cooperation, the Division Engineer wrote to every governor in the NAD area in 1956 to inform him of the work done by the Engineers in his state.[30]

Division Engineers also coordinated the workload among their Districts. In 1973, NAD's Division Engineer became concerned about an imbalance which gave Baltimore District too much work and Norfolk too little. He persuaded the Chief of Engineers to assign military construction in Virginia to the Norfolk District. A marked improvement in performance resulted. Furthermore, Division Engineers held periodic conferences with all their District Engineers to learn of difficulties and to provide guidance.[31]

Information flowed both up and down the chain of command. Through various means, Division Engineers kept the Chief of Engineers informed of the situation in their region. In the postwar period, the Chief of Engineers held Division Engineers' Conferences to facilitate communication. In addition, Division Engineers kept the Chief of Engineers informed through personal quarterly reports to him. On the whole, these concerned the status of projects in the Division.

The most common problem confronting construction projects was "slippage," a term used to describe an adverse deviation from the contract or time schedule. For example in 1954, the North Atlantic Division Engineer noted some slippages in Air Force contract awards in August. Construction of the runway extension at Dover AFB had been delayed because the real estate purchase had not been completed. A slippage of two days occurred on another small project because too much time was taken to evaluate the contract. At the Division's insistence, corrective action was taken in these cases, and a month later, all slippages had been eliminated.[32] In 1974, the Division Engineer reported that momentum was being lost on two major jobs because the contractor's attention shifted to other business. "We are moving out smartly," the Division Engineer reported, "to make sure that they remember us and their commitments to us."[33]

Sometimes, Division Engineers provided advice to the Chief of Engineers on the economic or political situation in their region or on the progress of particular programs of the Army. For instance, during the recession of 1974-75, the Division Engineer reported that:

> A change in the economic climate of the construction industry is in evidence. We are beginning to see a significant turnaround in what has been a difficult market. In June 1974, we rejected a single bid of $5.5 million for the hospital addition at Fort Lee [Virginia] — six months later we had 7 bids with a low of $4.2 million. . . Unfortunately we have not noticed a similar downturn in long term Civil Works projects.[34]

In response to the Chief of Engineers' request in 1974 for information on how NAD supported the Volunteer Army (VOLAR), the Division Engineer emphasized construction of modern new barracks and support of the Recruiting Command. He added:

> We continue to adhere to the Army's policy of mentioning the Modern Volunteer Army in our public utterances. In addition, I have had many informal discussions with leading members of the media here.... I have personally visited a number of Reserve Officers Training Corps units.... I have the distinct impression from many casual conversations with passersby in the New York streets that the Army's image is getting across to the American people. I find also among our customers..., that our efforts are well received, particularly in the area of Master Planning where our policy of continuing, direct contact between Engineer Districts and Army Posts is paying off.[35]

The Chief of Engineers expressed great pleasure with NAD's efforts on behalf of the Volunteer Army. "The low-key approach being taken by you and your District Engineers," he responded, "is precisely what I had in mind and is receiving a number of compliments from the Recruiting Command."[36]

The Chief of Engineers, in fact, frequently praised the excellence of NAD's performance. In September 1975, Lieutenant General William C. Gribble, Jr. wrote to the Division Engineer, Brigadier General James L. Kelly. He said that NAD's performance in awarding its portion of the Fiscal 1975 Military Construction, Army (MCA) program was "exemplary and was instrumental in the Corps achieving its best MCA awards record . . . FY 75 was our best year on record."[37]

Some Division Engineers' Formulas for Achieving NAD's Missions:

"to try to achieve as sound and efficient administration as possible to avoid cronyism or 'inside' friends and deal as fairly with everyone as possible. I insisted on courageous personal leadership by the District Engineers and their key personnel. . . ."

(Major General Thomas H. Lipscomb, Division Engineer, 1959-62, to the author, August 25, 1975.)

"I viewed the role of the Division and all its elements as being exclusively to provide services to others. I insisted that all of my people approach their jobs with a spirit of dedicated service. . . . In my view, the only reason for having a Corps of Engineers is to provide engineering services to the Army and to the people of the United States."

(Major General Richard H. Groves, Division Engineer, 1971-1974, to the author, September 3, 1975.)

In such a manner, the North Atlantic Division continued to evolve in the decades after the end of World War II. NAD's role expanded as the Chief of Engineers assigned new territories and new duties to the Division. The Division in turn provided more autonomy for its operating Districts. The result was a successful program of military construction for national defense.

VI
Conclusion

The military construction program in the decades after the Second World War represented the most extensive defense system since the multi-tiered brick fortress system constructed after the War of 1812. Concerned with the military power of the Soviet Union, the U.S. Government spent billions of dollars on national defense. The Engineers helped build a defense system unprecedented in its international scope and technological sophistication. American military installations were set up around the world. Weaponry and military facilities became increasingly complex. In an age of long-range bombers, missiles, and thermonuclear weapons, Americans relied upon their capacity to retaliate as a means of preventing assaults upon the United States or its major allies. The United States developed the means to provide early warning of assaults, to intercept the enemy when possible, and to ensure retaliatory capability.

The North Atlantic Division responded to these territorial and technological demands. Its experience in overseas military construction during the Second World War led to its being assigned similar responsibilities in the Cold War. To protect the Atlantic Community, its area of jurisdiction was once again expanded. It reached from the eastern coastline of the United States and Canada to the shores of the Mediterranean Sea. NAD created the necessary administrative machinery and procedures to build bases in different climes and cultures. The monuments to its engineering and construction skill stand today on the sands of North Africa, the shores of the Azores, and the frozen wastes of the polar icecap.

The Division also employed the latest construction methods and materials. Its familiarity with individuals, firms and conditions in the construction industry proved invaluable. Under NAD's supervision, architect-engineers and constructors erected modern facilities which incorporated the rapidly advancing technology. Among its significant achievements within the United States stand SAC bases, NIKE, BOMARC, and ICBM sites, and new buildings at the U.S.

Military Academy and at Walter Reed Army Medical Center.

The North Atlantic Region also benefited from the military construction in the area. Effective deterrence against attack upon America's centers of population, wealth and industry ensured continued survival of both the region and the Nation. At the same time, the area gained from the millions of dollars spent on these defense projects. In 1956 alone, NAD placed $196 million worth of such construction in six states.[38] This money was paid to architectural and engineering firms, construction companies, shippers, and the owners of real estate. They paid workers and suppliers who, in turn, purchased goods and services. As the Federal funds circulated through the economy, it became clear that this military construction not only provided defense but, like civil works, added to the prosperity of the region.

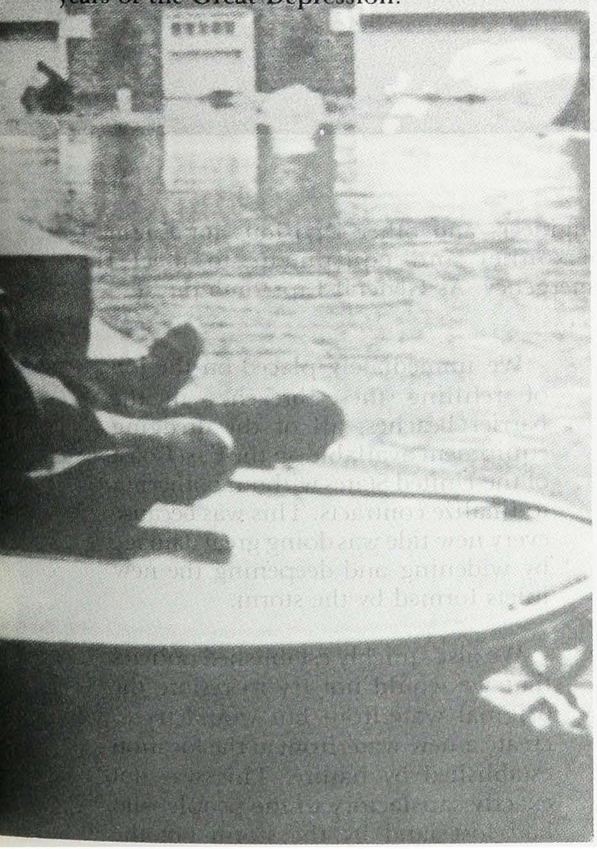
Governor's Mansion, Harrisburg, Pennsylvania. Partially Under Water, June 1972.

CHAPTER 6

Expanding Traditional Civil Works Activities, 1945-1975

I
Introduction

Traditional civil works activities of the North Atlantic Division expanded and became more complex in the three decades after World War II. A growing economy and increasing waterborne commerce required additional activity to maintain the region's waterways. Technological innovation resulted in increasingly sophisticated engineering and equipment. In addition, the Army Engineers took on new responsibilities in beach erosion and disaster relief, providing aid and reconstruction to storm-lashed communities. By the 1960s, NAD was spending at least three times as much on civil works projects as it had in the years of the Great Depression.

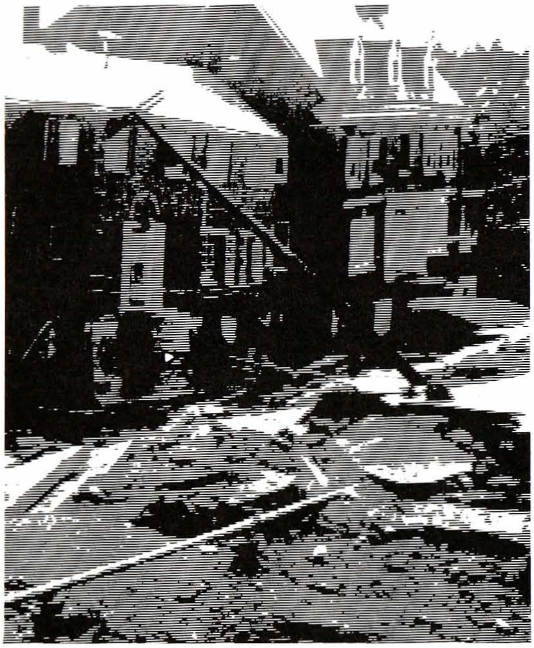


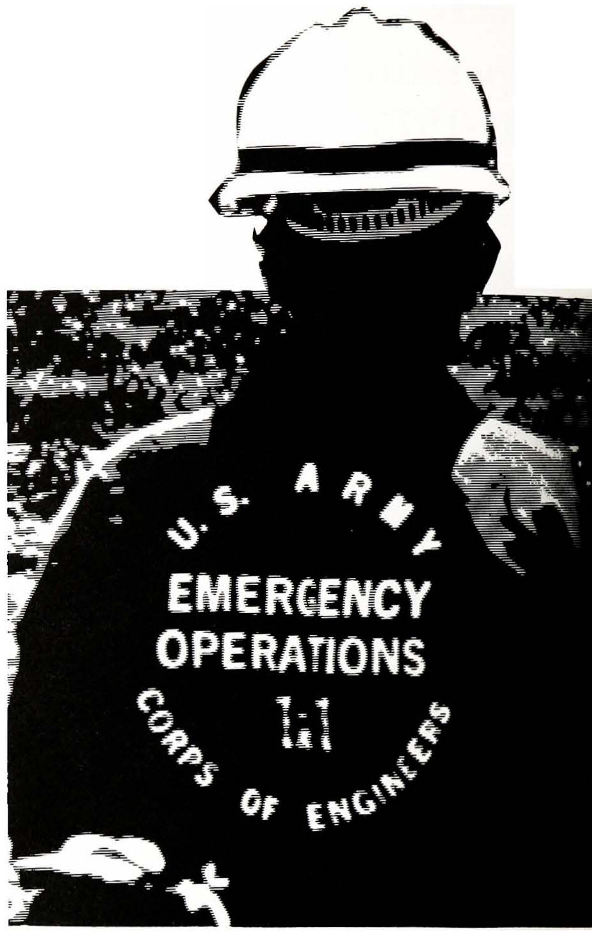
II
Disaster Recovery

Since the devastating flood in Johnstown, Pennsylvania, in 1889, the Army Engineers had periodically been called upon to aid the victims of natural disasters. In the years after World War II, the Federal Government expanded the mission and formalized it as a regular responsibility. Congress authorized the Army to undertake emergency restoration work in the wake of floods and similar disasters. The Corps of Engineers received the task because of its contracting capabilities, its decentralized organization, and its long experience in construction and flood control.

This expanded role in disaster recovery began for the North Atlantic Division when Hurricanes CONNIE and DIANE hit the Northeast within a few days of each other in 1955. Ninety-nine persons were killed and more than $120 million worth of property lost in the wake of the two hurricanes. In the disaster recovery project which followed, the North Atlantic Division spent $4.2 million assisting nearly 170 communities in Pennsylvania and New York. The Division directed the work of the Philadelphia and New York Districts. It coordinated liaison with State and local authorities and various Federal Agencies such as the Federal Civil Defense Administration. After inspecting the work, the Chief of Engineers praised "the steller job done by the North Atlantic Division in helping the people recover from the DIANE flood."[1]

Seven years later, a freakish cyclone caused a different kind of disaster along the Atlantic Coast. For three consecutive days in March 1962, the storm generated gale-force winds. It drove five successive, record-level tides against the barrier beaches of Long Island, New Jersey, and Delaware. Tide after tide carried away more of the beach, dunes, and bulkheads and cut deeper inland. This so-called "Five-High" Storm ripped houses from their foundations





Deadly Swath of Tropical Storm Agnes, 1972. Agnes slammed into the North Atlantic Region in the Spring of 1972, causing severe damage and loss of life. Authorities called it the worst natural disaster in American history. Corps of Engineers personnel began emergency clean-up operations immediately following the storm.

and inundated beach-front communities. Twenty-eight lives and 70,000 dwellings were lost. Damage was estimated at nearly $170 million. The President declared the states from New York to North Carolina as disaster areas.

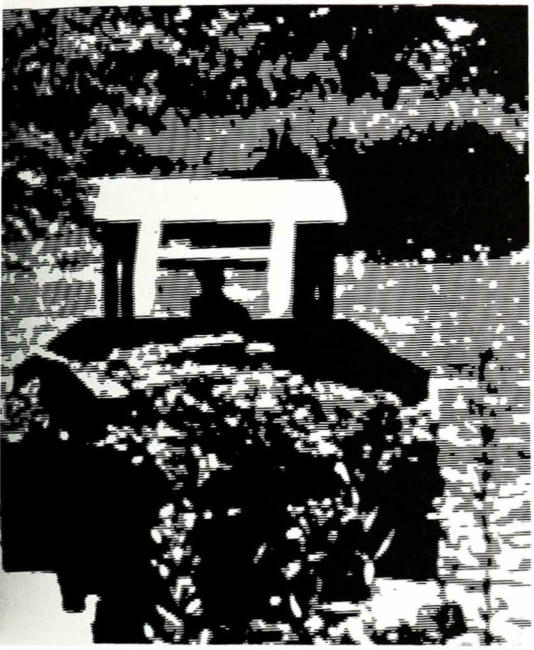
The North Atlantic Division helped provide immediate corrective action. The Office of Emergency Planning assigned NAD the mission of developing programs to estimate damages and set forth emergency restoration requirements. A major continuing threat, especially in New Jersey, was that the storm and the tides would change the shape of the shoreline. By dumping millions of tons of water past the barrier beaches, the turbulent seas had begun the process of creating new inlets and destroying the shape of existing ones. Major General Thomas Lipscomb, then Division Engineer, later recalled that he and his staff conferred with governors and legislators. They also called upon the Chief of Engineers and other Divisions for Engineer personnel and equipment to meet the emergency. As General Lipscomb put it:

> We immediately placed on the job of refilling these breaches in the barrier beaches, all of the dredging equipment available on the East Coast of the United States without bothering to finalize contracts. This was because every new tide was doing great damage by widening and deepening the new inlets formed by the storm.
>
> We also quickly established policies that we would not try to restore the original waterfront but would try to create a new waterfront at the location established by nature. This was not exactly satisfactory to the people who had lost land by the storm but the

governors and other key officials of the region recognized that it was the best that could be done and that could be supported with the taxpayer's money.[2]

The major portion of the emergency restorative work was accomplished within six months. Under the Division's supervision, 12 million cubic yards of sand was replaced and 85 miles of beachfront restored. Contractors erected 4,800 feet of boardwalk and 35 miles of sand fence. By December, NAD's mission in the wake of Operation Five-High had been completed.[3]

Several lesser disasters resulted from floods in Northern and Central New Jersey in 1971



and in New Jersey and Pennsylvania in 1975. However, the most significant recovery operation supervised by the North Atlantic Division stemmed from Tropical Storm AGNES in 1972.

Authorities classified Tropical Storm AGNES as the greatest natural disaster in the history of the United States.[4] Beginning off Mexico, the storm moved up to the Atlantic Coastline. On the afternoon of June 22, 1972, it suddenly veered inland near New York City and swept westward. Over the mountains of northern Pennsylvania and south central New York, it collided with a low pressure area. Torrents of rain fell upon ground already soaked from earlier spring rains. Almost instantly, small creeks and streams turned into raging torrents. Major rivers swelled ominously. The Susquehanna, only five feet deep at Harrisburg on June 21, crested three days later at nearly 33 feet, four feet above the river's previous record.

Massive flooding hit the region. Nearly a million cubic feet of water per second swept past Harrisburg at flood crest. Some of it spilled over, carrying mud and debris into the Capitol and the Governor's mansion. In the Wilkes-Barre area — one of the hardest hit — the Susquehanna surged five feet over the top of levees. More than 100,000 people fled their homes. Water that exceeded a depth of 20 feet in the downtown region inundated one-third of the city's residences. Flooding cut off utilities in the adjoining Wyoming Valley and swept away major bridges. In New York State, the Chemung River poured over its banks, creating a lake four miles wide between the cities of Corning and Elmira. The water cut off natural gas and phone service to 90 per cent of the users in the area. Businesses were flooded and shut down in both regions. From New York to Virginia, the storm and the flooding caused the deaths of 122 persons and property losses valued at $2 billion. On June 23, the President declared the states of New York, Pennsylvania and Maryland major disaster areas.

Such record-shattering devastation called for unprecedented action by the North Atlantic Division. NAD's Emergency Operations Center had kept track of the storm's path. Two days before the storm reached the New York area, the Division Engineer, Brigadier General Richard H. Groves, ordered his District Engineers to mobilize all available contractors in anticipation of flood-fighting and recovery work. As AGNES headed toward Pennsylvania and upstate New York, advance survey teams were sent there. In the wake of the storm, NAD dispatched more personnel and equipment to the affected areas. Within three weeks, the Corps had 84 people in the Wilkes-Barre Area Office alone. Aiding them were more than 700 local workers and 6,000 National Guardsmen. In the first 17 days, the North Atlantic Division awarded 610 contracts. General Groves personally signed an agreement with the Governor of Pennsylvania to prepare mobile-home sites for some 7,000 trailers that would provide housing for many of the homeless.

The disaster recovery operation placed a strain upon the Baltimore District because it already had one of the heaviest construction workloads of any District in the Corps. The North Atlantic Division Engineer sought to alleviate this difficulty. First, he directed the New York District to take over emergency relief work in the Susquehanna River Basin in upstate New York. This left Baltimore with responsibility for Pennsylvania and Maryland. Even this arrangement, General Groves concluded, would result in considerable delay on the District's operations. Accordingly, he recommended the creation of a temporary new District to deal solely with AGNES recovery operations.

The Chief of Engineers adopted General Groves' suggestion. On July 14, 1972 he established the Susquehanna Engineer District (SED). Its organizational structure was determined through discussions between representatives of NAD and the Office of the Chief of Engineers. SED would do the emergency work in the areas normally covered by the Baltimore and New York Districts. Its headquarters would be in Harrisburg, Pennsylvania. Its personnel would be drawn from Districts around the country and from the Pentagon, Fort Belvoir, and the Office of the Chief of Engineers. Equipment would come from the surrounding area. During the ensuing months, SED established nine area offices to manage the flood recovery work. It aided in the massive cleanup of mud and debris in the flood area. It assisted in establishing utilities hookups, constructing temporary bridges, and restoring roads. It helped to get water and sewage plants working again. It provided sites for mobile homes for the homeless. As a

preventive measure, the Engineers restored damaged dikes and levees and other local flood control measures.

The North Atlantic Division provided extensive supervision and support for the recovery effort. General Groves maintained personal contact with the SED District Engineer and visited the area on the average of twice a week. He took a personal interest in the so-called mini-repair program in which the Engineers restored utility hookups to some 4,000 residences. To General Groves, it was one of the most successful programs because in his words, "it brought us into contact with people directly, and above all, it kept people in their homes."[5] In the light of new data provided by the storm, NAD revised its data on the hydrology of the area. It distributed the new information to other government agencies to guide them in administering recovery grant programs. General Groves had no intention of continuing SED as a permanent District. Rather, as he had announced at the creation of the District, its object was to get in and get out of the disaster area as fast as possible, after getting the job done.[6] The flag was lowered at the Susquehanna District Headquarters on November 30, 1972, just over four months after it had been raised there for the first time.

The Division Engineer kept the Chief of Engineers informed of the accomplishments of NAD's performance in the AGNES recovery operation. General Groves considered the achievement monumental. By May 1974, he reported that NAD had spent more than $230 million on the project. At peak effort, some 600 members of the Army Engineers had been engaged. They had overseen the installation of 7,000 mobile home pads, the repair of 4,000 houses, the completion of 5,000 contracts, and the performance of 7,000 damage surveys. They had made 3,000 final inspections for the Office of Emergency Planning and the Federal Disaster Assistance Administration. The Chief of Engineers personally commended the Division for its accomplishments in the recovery efforts following AGNES.[7]

AGNES taught NAD and others a number of lessons. The Division began testing local flood protection projects — dams, levees, and pumping stations — prior to the spring rains. NAD also began an intensive effort to obtain better weather information. In 1973, it hired a private organization to provide round-the-clock surveillance of the weather in the North Atlantic Region. The forecasts proved timely and accurate and helped NAD respond effectively to flooding in New Jersey that summer. Based on the performance of the Susquehanna District, General Groves endorsed the use of temporary Engineer Districts in responding to such disasters. The Army Engineers' experience in the AGNES operation was studied by Congress in passing the Disaster Relief Act of 1974. General Groves remained proud of the Division's achievement. As he summarized it:

> So far as I know, we met every demand that was placed upon us and did so promptly, efficiently, and effectively.
>
> I am particularly proud of our record in the rather prosaic administrative side of our business. We entered into thousands of contracts — many of them on a handshake basis — yet within a year all of the files were complete and we were able to close them out without difficulty.
>
> The formation of the Susquehanna District was unique, and even more unique was our ability to get rid of it promptly once it had served its purpose.[8]

Capsule Biography

Major General Richard H. Groves

Division Engineer, 1971-1974

The man who headed the North Atlantic Division during the AGNES recovery mission, Major General Richard H. Groves, continued th high tradition of its Division Engineers. He was the son of Lieutenant General Leslie Groves, the Army Engineer who supervised the Manhattan Engineer District and the development of the Atomic Bomb during World War II. Born in Honolulu, Richard Groves attended Princeton University for two years before being appointed to the U.S. Military Academy where he was graduated in 1945. Following a tour of duty in Germany, he

attended the Harvard University Graduate School of Engineering, receiving a Master's Degree there in 1950.

During the 1950s, the young officer had a variety of assignments in the United States. He spent a year with the Mobile Engineer District, serving at Chattahoochee, Florida, and Muscle Shoals, Alabama. Afterwards he attended the Engineer Officers Advanced Course at Fort Belvoir, Virginia. In 1952, he was assigned to the Office of the Chief of Engineers as Assistant Executive Officer. Following that tour of duty, he took charge of constructing facilities in the British West Indies to support missile tests at Patrick Air Force Base in Florida. In 1956, he returned to the Office of the Chief of Engineers. He conducted a number of personnel studies before going to the U.S. Army Command and General Staff College at Fort Leavenworth, Kansas. In 1957, General Groves' assignment took him to the Faculty of the U.S. Army Engineer School at Fort Belvoir.

In the early 1960s, General Groves received a number of assignments with the U.S. Armed Forces in Europe. He served as Chief of Maintenance of the American Battle Monuments Commission's European Office. In 1962, he assumed command of the 12th Engineer Battalion, 8th Infantry Division, Germany. This battalion had airborne capacity and General Groves became a certified parachutist.

General Groves returned to the United States in 1963. He attended the Air War College at Maxwell Air Force Base in Alabama. Afterwards, he received an assignment to the Pentagon where he served first as an action officer and later as a division chief in the Office of the Chief of Staff, U.S. Army. In 1966, he was named Military Assistant to the Secretary of the Army.

In 1967 and 1968, General Groves was assigned to the U.S. military effort in Southeast Asia. He assumed command of the 159th Engineer Group in Long Binh, Vietnam. Early in 1968, he studied the military

construction, real estate, and maintenance programs of the U.S. Army in Vietnam. Shortly afterward, he assumed command of the U.S. Army Engineer Construction Agency, Vietnam.

In August 1968, General Groves returned to the United States and was assigned to the Office of the Chief of Engineers to participate in a study of the Army's real property maintenance activities. In January 1969, he became Deputy Director of Civil Works in the Office of the Chief of Engineers.

General Groves became North Atlantic Division Engineer in September 1971. He was promoted to the rank of Major General in February 1972. He served until September 1974 when was reassigned as Deputy Chief of Staff, Engineer, U.S. Army in Europe.[9]

Left. Major General Richard H. Groves, Division Engineer, North Atlantic Divison, 1971-1974.

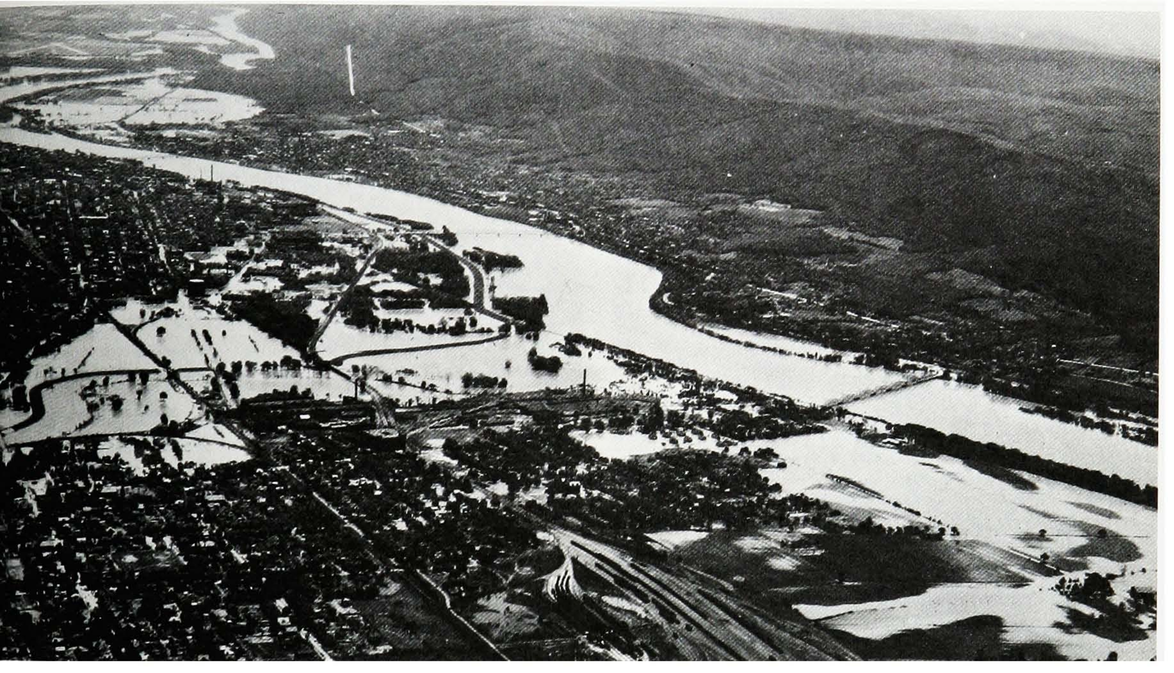
Top Below. Williamsport, Pennsylvania, During 1946 Flood.

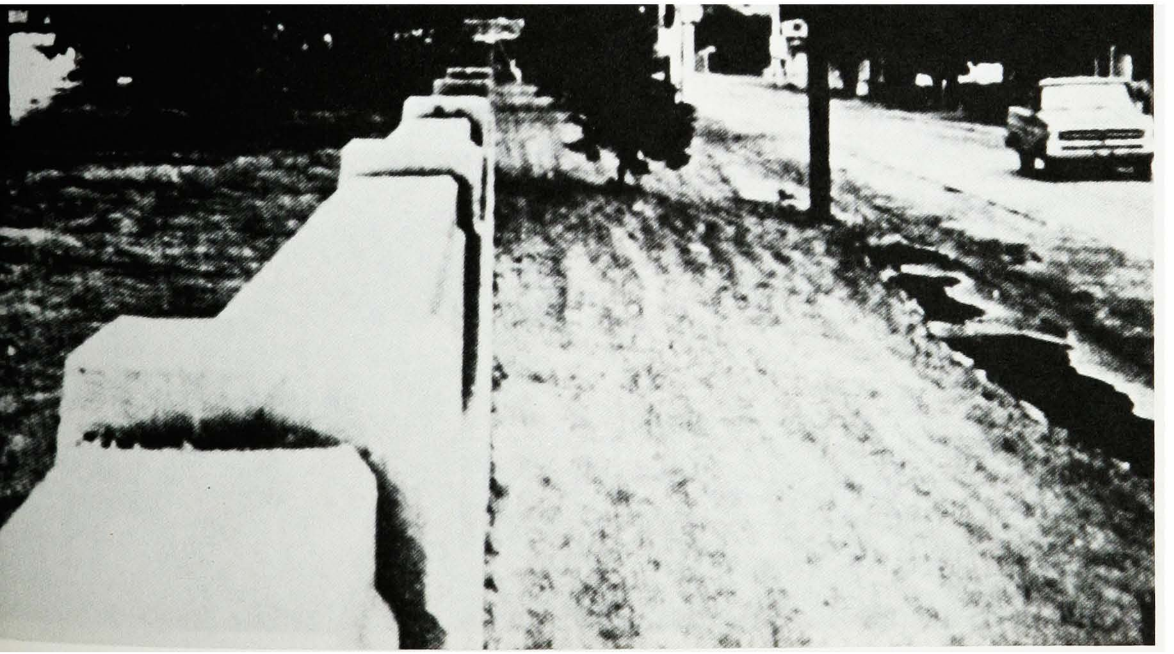
Bottom Below. Floodwall in Sunbury, Pennsylvania.

III

Flood Control Work

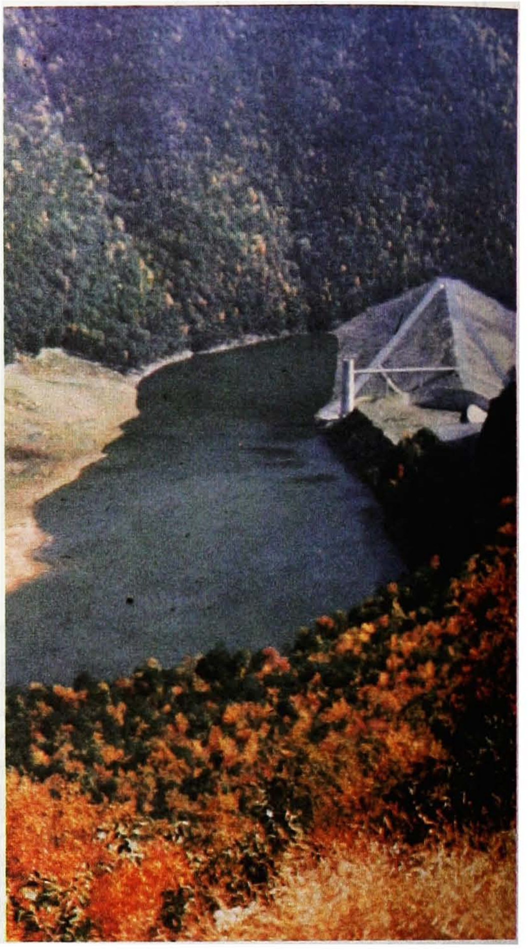
Flood control represents a preventive side of disaster relief. During the postwar decades, two major developments occurred within the



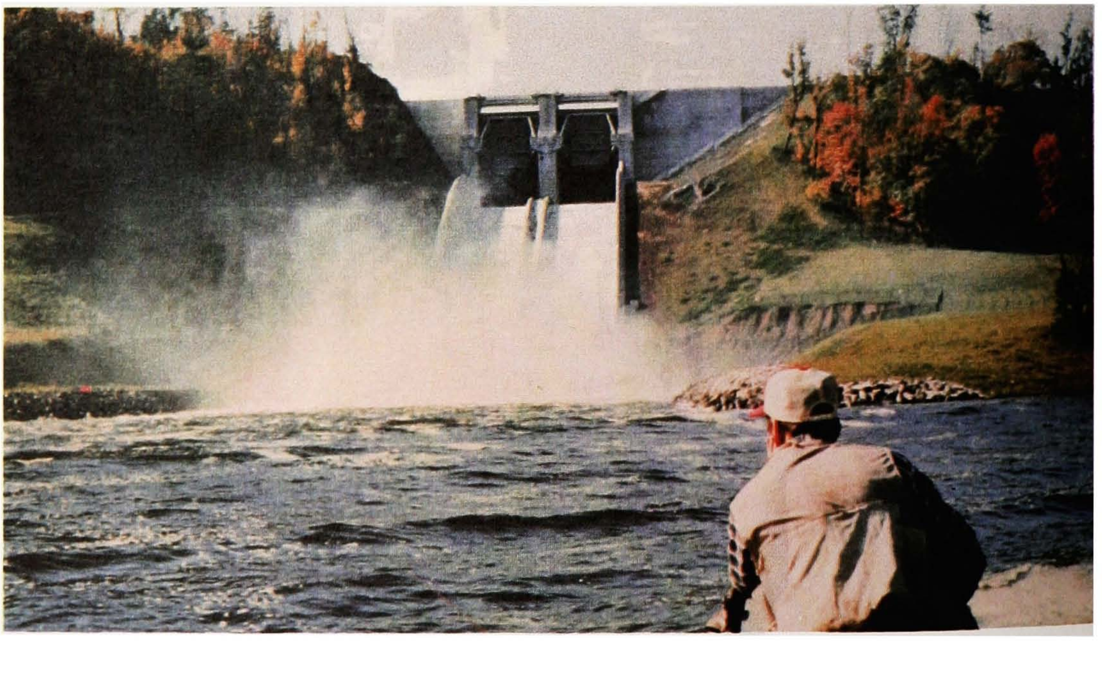


Top. Alvin R. Bush Dam on Kettle Creek, a Branch of the Susquehanna River, in Pennsylvania.

Bottom. Recreation Area at Raystown Lake, Huntington, Pennsylvania.



North Atlantic Division in this mission. First, the primary emphasis shifted away from downstream flood control projects such as levees and retaining walls. Instead, the Corps emphasized controlling flood plain damage through upstream dams and reservoirs. Previously, most upstream interests —farmers, villagers, and others — had been unwilling to sacrifice their land for reservoirs designed to benefit people living downstream. The second major development — the construction of multipurpose dams and reservoirs — gave new incentives to the upstream interests. Under Congressional legislation beginning in 1944 multipurpose projects were authorized. Less expensive electricity from these dams could bring industry and employment to the upstream areas. Recreational facilities encouraged tourism and increased demand for real estate and services. Despite the loss of some property, remaining land values rose and the area's economy improved.

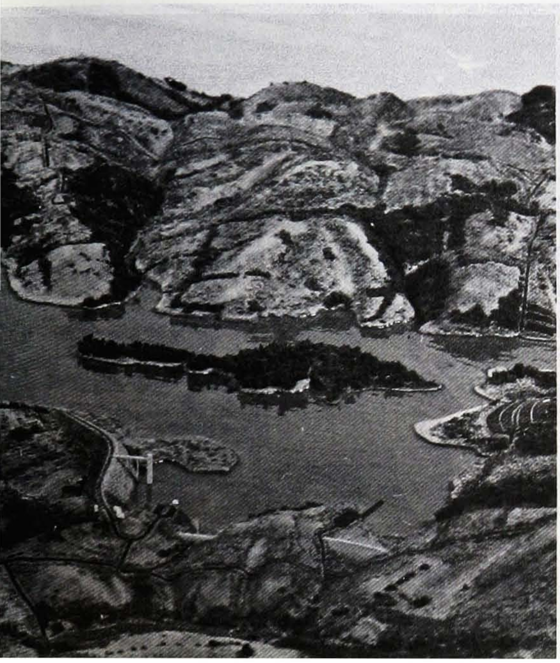


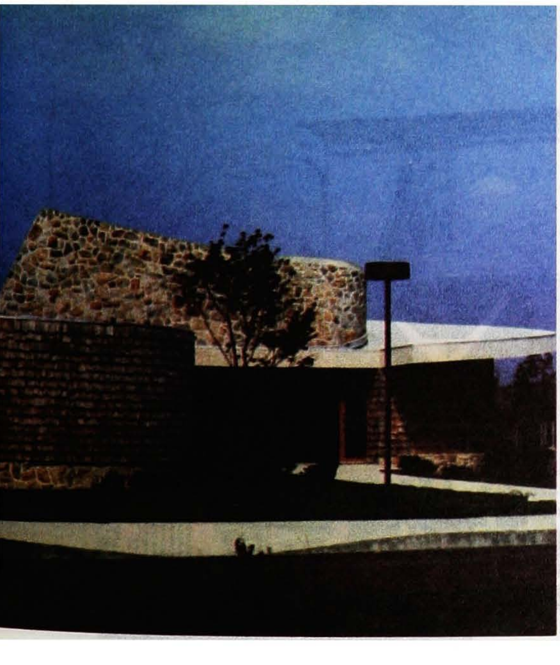
Top Below. Model of Blue Marsh Lake near Reading, Pennsylvania.

Bottom Below. Overlook and Visitor's Center, Blue Marsh Dam near Reading, Pennsylvania.

Top Right. Recreation Area, Beltsville Dam on the Pohopoco Creek in Pennsylvania.

Bottom Right. Tioga-Hammond Dam and Lakes, Tioga River, Pennsylvania.

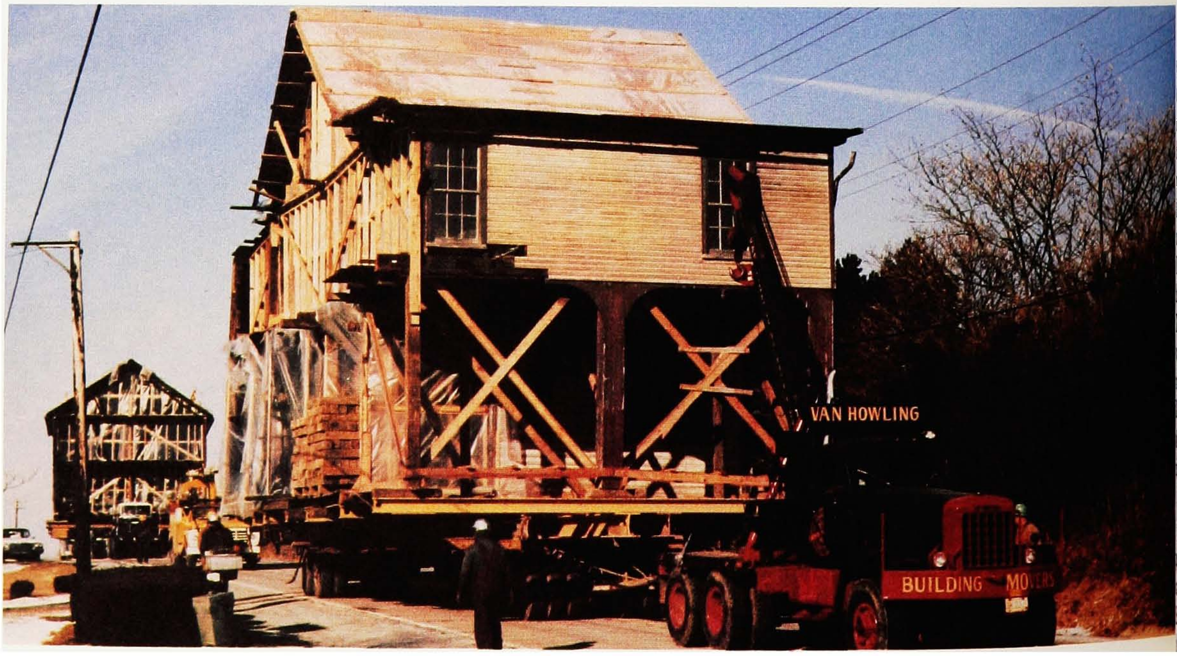




Within the North Atlantic Region, the Engineers built multipurpose earthen dams and accompanying reservoirs in many major river basins. Construction began in the late 1940s, but it grew in volume in the 1950s and the 1960s.

The historic Gruber Wagon Works, a 19th Century family factory, would have been inundated and destroyed by the Blue Marsh Lake. To preserve it, the Corps of Engineers obtained designation for it as a national historic landmark and a special appropriation from Congress to relocate the single, two-story wooden building. The building was then lifted upon a trailer and driven to a safe location a few miles away.

The Foster Joseph Sayers Dam on a tributary of the West Branch of the Susquehanna River demonstrated some of the problems in construction which the Division had to overcome. The site for the dam was on Bald Eagle Creek about one mile upstream from Blanchard, Pennsylvania. Behind an earthfill structure, 100-feet high and 6,800-feet across, Engineers projected a lake nearly 10 miles long. The little Borough of Howard would have been inundated and its residents protested. In response, the Engineers designed a new village site for them. But the townspeople did not want to move and the Army Engineers respected their wish. To protect the town, they constructed a mile-long earthen levee. It kept the lake waters from spilling over and swamping the hamlet. The Foster Joseph Sayers Dam was built between 1965 and 1969 at a cost of $31 million and was named for a World War II Medal of Honor winner from the remote Pennsylvania county. During the flooding that accompanied Tropical Storm AGNES, the dam protected



property valued at $44 million which might otherwise have been destroyed. In 1973, recreational facilities were added to the lake. Some 174,000 persons used them the following year.[10]

Division Engineers maintained close supervision over the construction and maintenance of the flood control projects. They monitored progress on the projects and inspected the work to ensure that it met the Corps' standards. In 1956, for example, the Division Engineer warned the Chief of Engineers that a number of levees had deteriorated to an alarming extent because of the accumulation of debris. Calling this an emergency situation, he advocated the use of funds under Public Law 84-99 which authorized the strengthening of flood control works threatened or destroyed by floods.[11] This was later adopted as a Corps-wide policy. In 1974, the Division Engineer reported to the Chief of Engineers on the correction of a dangerous situation at Waverly, New York. There a small water supply dam had been in danger of failing and flooding the town. Engineers reduced the pressure on the dam by gradually lowering the water level. "We were called upon to provide emergency relief," he reported, "and the Baltimore District did so successfully and with commendable speed.... Our efforts at Waverly have been very well received and on the whole this has been a most satisfying episode."[12]

Other innovations occurred under NAD's supervision. In 1973, the Division Engineer told the Chief of Engineers that NAD had made the first use of contracted, instead of in-house expertise to evaluate construction management on a civil works project. Previously, the technique had been employed on military projects, such as the hospital at the U.S. Military Academy. But in 1973, NAD hired consultants to assist in the design of the Tioga-Hammond Lake project in Pennsylvania. Because of the potential of using contracted consultants to reduce costs, the Division Engineer considered the application of this technique to be the most significant civil works activity in the Division that year.[13]

Planning and construction of multipurpose projects sometimes became enormously complex. On civil works projects, the Army Engineers employ standard planning procedures including cost-benefit analysis, environmental impact statements, and analysis of social impact and the availability of cooperating local agencies. Sometimes a situation changes so dramatically that the original Congressional mandate for the Corps to proceed with a project is reversed. When this happens, Division Engineers seek to assess such changes and act realistically as a result of the changes in sentiment.

The most significant recent example of such a change in attitudes and of the Division's response to that shift involved the mammoth Tocks Island Lake Project. At issue lay a plan to construct a dam and reservoir on the Delaware River north of the Water Gap. The estimated cost was $400 million. The project included a large earthen dam, a 37-mile-long lake, and a 72,000-acre park. The multipurpose project was designed to provide flood control, water supply, electric power, and recreation for the heavily-populated urban-suburban areas of New York, New Jersey and Pennsylvania.

The North Atlantic Division began work on the Tocks Island Lake Project following the storm-caused flooding of 1955. The Engineers determined that future floods in the area could be reduced by constructing a dam on the upper Delaware River. During the 1960s, a severe drought in the area caused increased concern about future water supply for the region. The Corps confirmed that the proposed reservoir could be a major source of water. In addition, the lake and shoreline would provide additional recreational facilities for the growing urban population of the tri-state area. In 1962, Congress authorized construction of the dam and in 1965 amended the project to also include park facilities. Authorities expected the Delaware Water Gap National Recreation Area to serve the needs of an estimated 10 million visitors a year.

In the late-1960s and early-1970s, however, despite support from many interests, a number of challenges undermined the Tocks Island Lake Project. These came from many who would be displaced from the inundated area and from a coalition of environmental groups. They argued for preservation of the pristine quality of the free-flowing river and the adjoining land. Responding to the environmentalist pressures, General Groves urged that conservationist concerns be balanced by the needs of an expanding population for water-

related programs. If the population of the region continued to grow and people continued to insist upon an increasing standard of living, he asked, how would it be possible to conserve undeveloped areas?[14]

In 1974, Congress sensed a change in public opinion and ordered a re-evaluation of the needs and effects involved in the proposed project. The North Atlantic Division contracted with two New York City consulting firms for the $1.5 million Tocks Island Lake Comprehensive Review Study. The Division held public hearings in conjunction with the firms with the Delaware River Basin Commission. The massive study which was completed in June 1975 presented analyses and alternatives rather than recommendations. The North Atlantic Division Engineer, Major General James L. Kelly, assessed the six-volume report and presented his findings for the Chief of Engineers and for the Delaware River Basin Commission. He recommended that the Tocks Island Lake Project proceed to construction. Concluding that the design was sound, he asserted that the economic benefits accruing from the project to the tri-state area would outweigh any adverse impact upon the environment. Harm to the environment could be greatly reduced, he said, by adequate control over land use, by development of a well-coordinated program for managing traffic, and by planning proper recreational and public support facilities. General Kelly recognized that the immediate decision remained with the governors of the states involved, who were members of the Basin Commission. "The Governors. . ," he concluded, "can best evaluate the conflicting views of their constituents."[15]

At the Basin Commission meeting of July 31, 1975, a majority of the governors asked Congress not to appropriate any money for construction of the Tock Island Dam. Only the governor of Pennsylvania voted for the project. He said that the lack of a dam would leave the northeastern cities short of water in period of drought and would endanger the cities along the Delaware River during floods. The Basin Commission, however, did recommend that Congress complete the acquisition of 72,000 acres of land in the area. NAD had already purchased 48,000 of these. The land would provide the basis for a national recreational area around a free-flowing river rather than a dam and reservoir. Since the majority of the Basin Commission no longer supported construction of the Tocks Island Lake, the Division Engineer recommended deauthorization of the project. He suggested that the Basin states seek other solutions to their water and recreational needs. The Chief of Engineers concurred with General Kelly's recommendation.[16]

IV

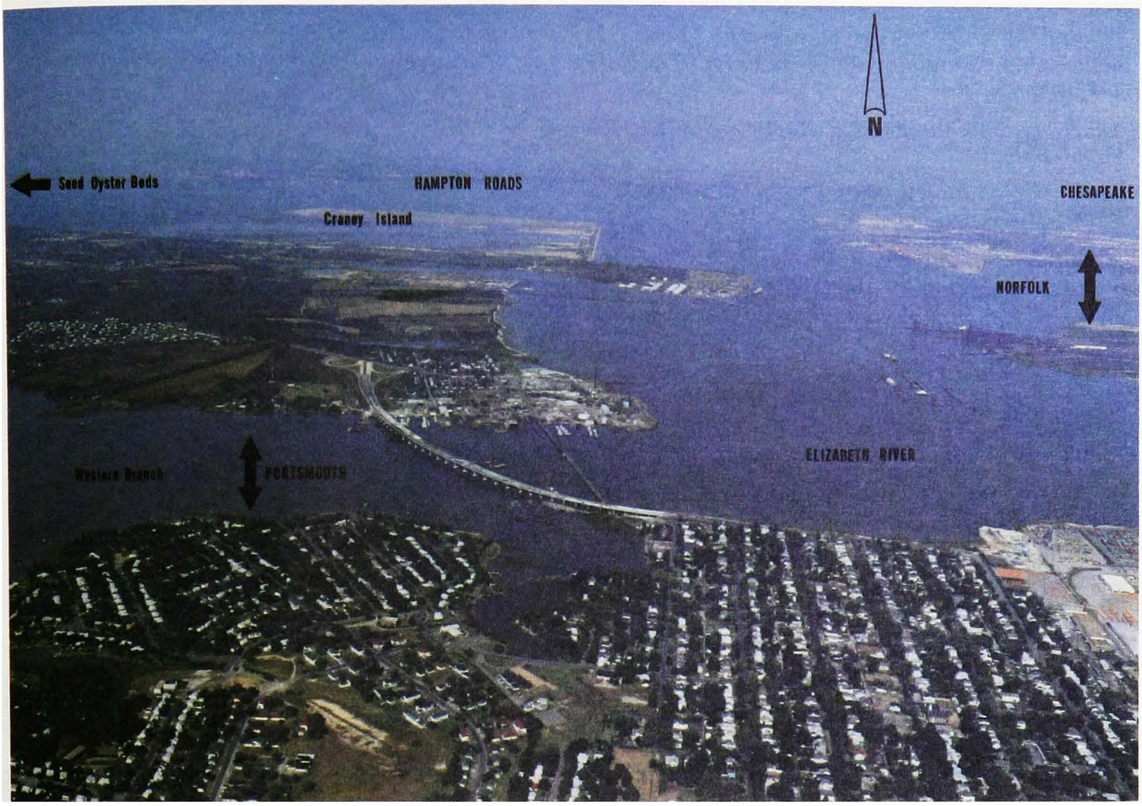
River and Harbor Work

In the expanding economy of the postwar decades, the growth of waterborne shipping required additional navigational improvements to maintain the increasing volume of traffic and to accommodate larger vessels. In the decade after 1945, tonnage going through the Port of New York increased by more than 50 per cent. In the thirty years after the war, the tonnage carried by barge traffic in the United States doubled.[17] Increased traffic and bigger vessels required deeper and wider channels and anchorage areas. As in the past, the North Atlantic Division supervised the dredging in some of the busiest ports in the land. In the postwar years, these ports were deepened to 45 feet.

Division Engineers kept abreast of developments and potential areas of concern. In the middle 1950s, they worried about lack of competitive bidding, and prices for dredging work which they considered excessively high. They ordered District Engineers to consider using Government dredges and hired labor when there was a lack of interest and competition from private dredging companies.[18] They also tried to ensure that dredging work would proceed on schedule. In 1954, the Division Engineer reported the discontent of local interests in Philadelphia and New York. They believed that navigation improvement in their areas was not receiving funding equal to that being given to other

Top. Craney Island Spoil Disposal Area, Norfolk, Virginia.

Bottom. Spoil Discharged Through Hydraulic Pipe.

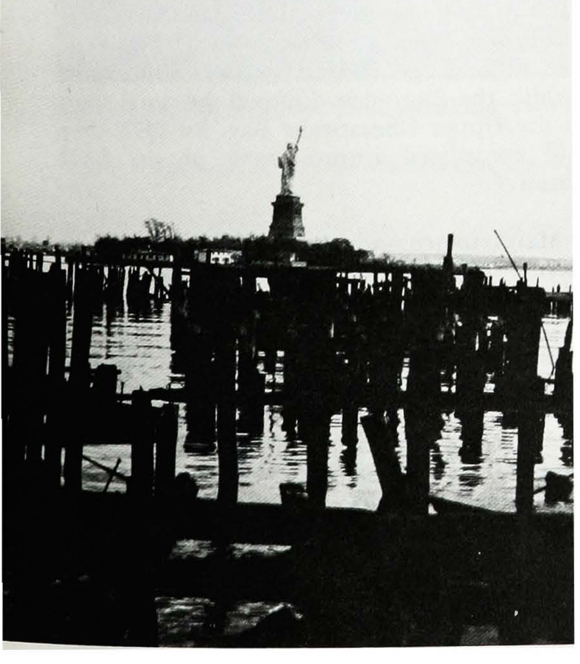

N
Seed Oyster Beds
HAMPTON ROADS
Craney Island
CHESAPEAKE
NORFOLK
Western Branch
PORTSMOUTH
ELIZABETH RIVER

Top Below. Old Railroad Bridge Spanning Chesapeake and Delaware Canal.

Bottom Below. Chesapeake City Bridge over Chesapeake and Delaware Canal.

Top Right. Corps Vessel Gorham *Collecting Drift in New York Harbor, 1973.*

Bottom Right. Rotting Piers Create Drift in New York Harbor.



regions of the country.[19] Thus, the Division Engineers helped to keep the Chief of Engineers aware of local sentiment as well as local conditions.

Enlargement of the channels serving the Port of New York represented a major navigational improvement in these years. During the 1950s and 1960s, Congress authorized projects to deepen and widen the channels and anchorage areas there. Projected costs ran more than $60 million. Division Engineers generally concurred in recommending that the main channels be dredged to depths as great as 45 feet in order to handle the larger new vessels. There were exceptions, however, where they concluded such action to be unwarranted. A former Division Engineer, Major General Thomas H. Lipscomb, recalled one such incident which had occurred in 1962:

> I personally nixed the deepening of the channel back of Staten Island in Arthur Kill by 3 feet to allow larger tankers to go back there. The channel was so narrow that it was hardly safe for the big tankers then using it and the cost of deepening by 3 feet was going to be many hundreds of millions of dollars. It required a good deal of courage since the oil industry was strongly for it but 13 years of history since then have certainly indicated it was a sound thing to do.[20]

The general public became concerned about the environment in the 1960s and 1970s. The Corps of Engineers had been concerned for some time, but the change in public opinion led to alterations in the policies directed by Federal, state and local governments. For example, the question of where to dump the "spoil," the material dredged from the river and harbor bottoms, became a major issue. Controversy surrounded the dumping of dredged material at Craney Island in Hampton Roads Harbor, Hart-Miller Islands in Chesapeake Bay, at several spots along the Delaware River, and in the New York Bight outside the city's harbor. In New York Harbor, the Corps' dredge *Essayons* and other floating plant disposed of 8 to 11 million cubic yards of spoil from the harbor bottom each year. Along the Delaware River, the area available for disposal of dredged material became more restricted as riparian real estate was held for commercial development and the marshlands

were preserved for wildlife. Disposal of dredged material increased cost of river deepening. The ability to obtain disposal areas often determined which contractor would be awarded the dredging job.[21] The problem of dredged material disposal remains unsolved.

The Division's drift removal program, however, pleased almost everyone, including the environmentalists. Under Congressional authorization, the Engineers began collecting drift in the harbor waters in 1915. They sought to reduce the damage to ships and boats from floating logs and timbers. In New York Harbor, the debris came from many sources, but primarily from the hundreds of rotting hulks and wharves that dotted the 900 miles of waterfront. By the 1970s, the Corps had spent $17 million collecting and disposing of more than 24 million cubic feet of driftwood.

Specially-designed boats performed the work. The appropriately-named *Driftmaster* was the largest of these craft. Built in 1948, it became the first self-propelled vessel designed solely for the collection of drift. The 100-foot-long catamaran-type vessel could scoop up and remove 16 tons of debris.

For nearly 60 years, the Corps could only collect debris already floating in the harbor. However, the Water Resources Act of 1974 empowered the Engineers to remove the sources of the debris as well. Almost immediately, NAD began to survey and remove derelict vessels and deteriorating piers. The program gained widespread endorsement. Reporting to the Chief of Engineers in May 1974, the Division Engineer concluded that "of all the projects within my Division, this undoubtedly has the greatest across-the-board support."[22] Local communities anxiously sought to enlist the Corps in clearing their waterfront areas.

As part of its responsibility for maintaining navigable waterways, the Division supervised a significant amount of work on canals. It also supervised construction and maintenance of the bridges which crossed these and other waterways.

One major project dealt with the New York State Barge Canal, an expansion of the old Erie Canal System. In the early 1960s, the Federal Government, following adverse recommendations by the District and Division Engineers, turned down New York's request that the Federal Government assume control of the costly system. As one Division Engineer, Major General Lipscomb, remembered it:

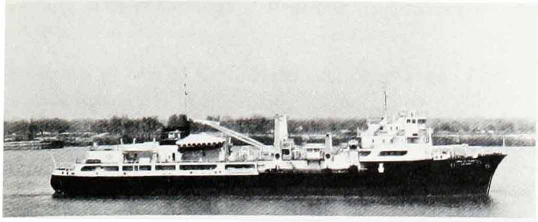
> We simply said "NO" to Governor Rockefeller when he wanted us to take over the Erie Canal and operate it at a high annual operating cost when our preliminary investigation showed that the Canal did not have any navigational value except for recreational boating. We insisted that it be retained by the State of New York.[23]

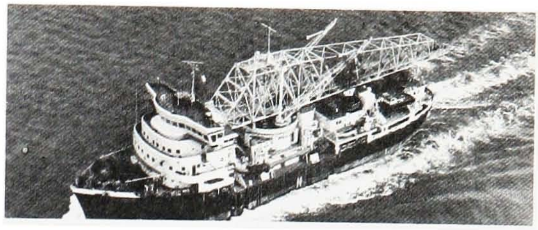
At the direction of Congress, however, the Engineers did assist New York in modernizing part of the canal system. However, the State retained ownership and responsibility for its operation. Improvement included deepening and widening the waterway and providing for 20-foot bridge clearance. The $34 million project which covered 184 miles was completed in 1968.[24]

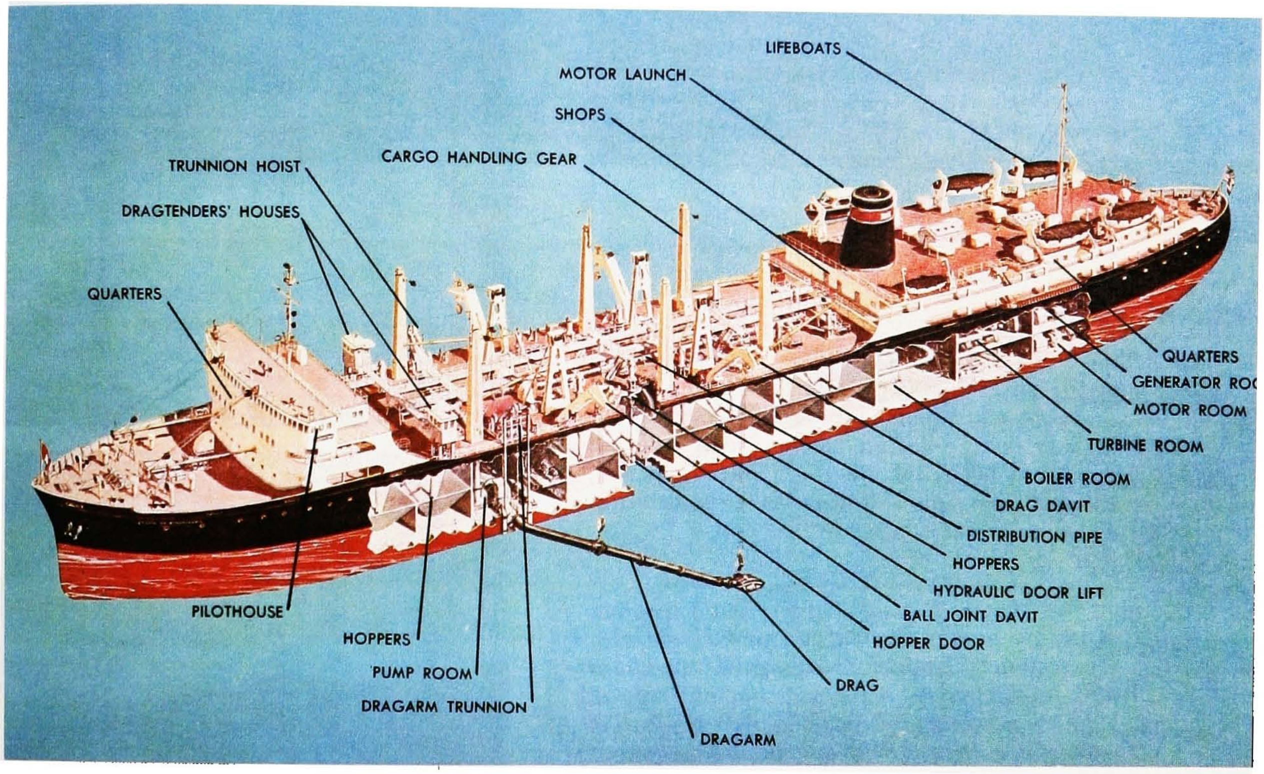
The North Atlantic Division also supervised modernization of the Federally-owned Chesapeake and Delaware Ship Canal. In 1954, Congress approved a plan to widen the waterway to 450 feet, deepen it to 35 feet, and ease its sharpest curves. As with river work, canal dredging produced spoil which had to be disposed of in ways both economically and environmentally acceptable. After adequate public notice and coordination with both state and Federal agencies and with the interested public, the Engineers dumped the canal spoil in the Upper Chesapeake Bay. By 1975, they had completed improvement of the C&D Canal.[25]

Maintenance and improvement of Government canals included work on their bridges. Shipping accidents had demolished two bridges on the C&D Canal, the St. Georges Bridge in 1939 and the Chesapeake City Bridge in 1942. NAD supervised construction of a new St. Georges Bridge, opened in 1942, and a high-level Chesapeake City Bridge, which began to serve traffic in 1949.

On April 16, 1974, a tugboat hit a bridge and closed another canal, one which connected Chesapeake Bay with Albermarle Sound. With NAD's assistance, the Norfolk District reopened the waterway within 24 hours.







Top Left. Corps of Engineers' Dredge Markham *built in 1960.*

Top Right. Corps of Engineers' Dredge McFarland *built in 1967.*

Bottom. Typical Hopper Dredge Components (Dredge Essayons).

Within three weeks, it repaired the bridge and reopened it to vehicular traffic.[26]

As part of the improvements authorized on the Chesapeake and Delaware Canal, the Philadelphia District constructed three new bridges. Engineers replaced an old lift bridge with a four-lane, high-level highway bridge at Summit, Delaware in 1960. They completed another high-level highway bridge at Reedy Point in 1968. In 1973, the Division finished a new crossing for the Penn Central Railroad at Lorewood. The railroad bridge went into service 10 days ahead of schedule.[27]

V

Marine Division

During two postwar decades, the North Atlantic Division undertook a unique function involving the work of the new Marine Division (MD). This new unit operated within NAD between 1951 and 1973. It supervised the work of the renamed Marine Design Division (MDD). From its location in Philadelphia, the MDD designed and contracted for construction of the floating plant for the entire Corps of Engineers. From New York, NAD's Marine

Division monitored all hopper dredge operations throughout the Corps and kept track of construction, maintenance, and improvement of the Corps' floating plant. The Marine Division also reviewed all of MDD's design and contract work and supervised several marine studies. The work of the Marine Division represented a major new responsibility for NAD.

The Marine Division served as a middle-level supervisory agency for the floating plant. Design, construction and inspection of marine equipment had first been done in Washington, D.C. and then, after 1938, in Philadelphia. During that period, NAD exercised nominal supervision. The Chief of Engineers' Office continued to direct MD's operations. This situation changed in 1951 when Henry G. A. Hayward, a Marine Engineer, was assigned to the North Atlantic Division to head the newly-created Marine Division. He also became the chairman of the Corps' Hopper Dredge Board, a body which recommended policies for hopper dredge design and construction and reviewed all work on the floating plant. Eventually, Louis J. Mauriello succeeded him as head of NAD's Marine Division.[28]

The Marine Division supervised a number of innovations in the Corps' marine program. Two modern hopper dredges, the *Markham* and the *McFarland*, were launched in 1960 and 1967 respectively. In 1968, the Engineers converted a World War II Liberty Ship into a non-propelled floating power plant and renamed it the *Sturgis*. The vessel used a pressurized water nuclear reactor to provide 10,000 kilowatts of electrical power from its mooring in the Panama Canal Zone. For service on the St. Lawrence Seaway, the Corps constructed the *Grasse River*, a 350-ton lock gate lifter. NAD also supervised the construction of numerous patrol launches, survey boats, towboats, motor launches, derrick-boats, and other vessels. To keep its floating plant repaired, NAD spent an average of $3 million a year in the 1960s.[29]

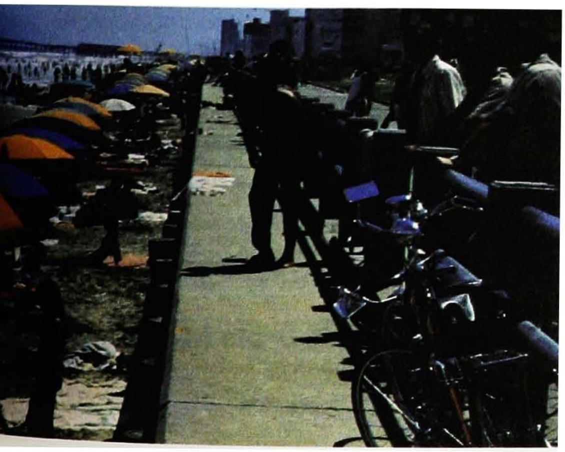
In 1973, supervision of the Marine Design Division was transferred to the Directorate of Civil Works of the Office of the Chief of Engineers. After 22 years, a unique chapter in the history of the North Atlantic Division had ended.[30]

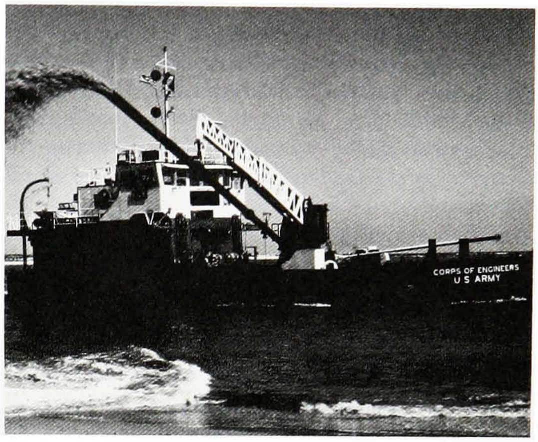
Top Below. Replenishment of Beach at East Rockaway, New York.

Center Below. Beach at East Rockaway, New York, After Replenishment.

Bottom Below. Beach at Virginia Beach, Virginia, After Replenishment.

Right. Corps of Engineers' Dredge Fry *Sidecasting Sand Onto Beach.*





VI

Beach Erosion Control

Restoration of coastal beaches provided an unexpected use for the Division's fleet of hopper dredges. These vessels could lift up sand from offshore deposits and dump it onto eroding beaches. Congress authorized expanded use of the hopper dredges for this purpose in the 1950s and 1960s.

Concern for the reduction or disappearance of many of the Nation's beaches became especially critical in those years. At New York's Fire Island, for example, local residents tried to save their beaches by setting up barricades ranging from rocks to piles of old automobiles. The sea, however, mocked their efforts. At Cape May, New Jersey, inhabitants moved shorefront houses inland on three separate occasions as the sea pounded its way toward them. At Virginia Beach, the famous three-mile strand had virtually disappeared and the boardwalk became surrounded by water. Both storms and man-made structures contributed to this erosion. Improperly placed seawalls and groins often interrupted the littoral drift process by which the wind and waves

alternately carried away and replenished the sand of the beaches.

Congress empowered the Corps of Engineers to help State and local communities prevent such damage and replenish eroded beaches. The Federal Government agreed to pay up to 70 per cent of the cost of such replenishment, but state and local authorities had to maintain the improvement.

NAD hopper dredges replenished a number of beaches in the North Atlantic Region. At Fire Island, New York; Sea Girt, New Jersey; and Virginia Beach, Virginia, Engineers used a Corps-devised direct pumpout system. Government dredges removed sand from 40-foot depths offshore or lifted it from local channels. Through a discharge system of hydraulic pipeline, they pumped it onto the beaches. The Virginia Beach replenishment project began in 1953. With the Engineers assistance, the community soon rebuilt its beach. In the 1970s, the Division stored over 500,000 cubic yards of sand on Virginia Beach from the dredging of Thimble Shoals Channel at the mouth of Chesapeake Bay.[31]

Such projects provided lessons for the Corps. The dredging costs allocated to the sand storage project at Virginia Beach amounted to slightly less than $1.00 per cubic yard. This unusually low figure became possible because of the Division's ability to combine the annual dredging of Thimble Shoals with the beach nourishment program. In anticipation of similar future work, NAD designed a modified floating pier which would eliminate the need for a mooring barge. The Division Engineer recommended that the Corps develop equipment that would enable it to conduct all-weather beach nourishment programs from offshore sand deposits.[32]

VII

Conclusion

The trend toward nationalization of issues continued in the postwar period. Because people wanted greater security and more services, many local matters became Federal responsibilities. In these years, the Federal Government increased its involvement in housing and health care, civil rights and civil works. In the latter area, it accepted new responsibilities in multipurpose use of water resources, control of beach erosion and harbor debris, and assistance in disaster recovery work. The Army Engineers served as the Government's primary construction and water resources agency. Their engineering and construction ability and their success in providing cooperation among Federal, State and local agencies led to these assignments.

The North Atlantic Division responded to the new demands. Techniques from military construction and earlier civil works operations were applied successfully dealing with local interests, government agencies, and contractors. On the whole, the Division operated within the existing Corps' framework. When necessary, however, it established temporary Districts to accomplish specific tasks, as it had done during World War II.

The expanded civil works missions aided both the Division and the North Atlantic Region. The Engineers gained from the increased knowledge and experience which came from these operations. Mobilizing against a natural disaster taught logistical lessons which could be useful in wartime mobilization. The Engineers also earned prestige and support as a result of their efforts. The North Atlantic Region benefited in a number of ways. A national agency like the Corps could more easily bridge the various political boundaries which separated upstream and downstream interests in different states, the many communities in an entire river basin, or the scattered settlements along a coastline. The Corps brought engineering skills, organizational ability, and Federal funds to develop projects which otherwise might not have been possible. As the Engineers' water resource projects increased productivity, the entire region benefited in the enhanced security and prosperity which resulted.

CHAPTER 7

Meeting New Challenges, 1960-1975

I

Introduction

The 1960s and early 1970s brought a number of new challenges to the North Atlantic Division. These accompanied a new awareness of the need to balance economic expansion and national defense with protection of the environment. The curtailment of pollution and the conservation of energy became important new national goals. Consequently, NAD received added responsibilities in environmental regulation. As a water resources agency, it conducted several major studies of the region's water needs. As the government's major construction agency in the area, NAD built facilities for Civil Defense, U.S. Postal Service, and for the expanded U.S. Army Reserves. In sum, NAD continued to face new challenges as it responded to the changing needs of the American people.

II

Environmental Regulation

Because of increased public awareness of environmental issues, the North Atlantic Division received additional authority to protect the waters of the United States. Congress empowered the Engineers to control construction and the dumping of material which would adversely effect the environment. The Division exercised this authority through its permit program and its review of environmental impact statements.

The permit program originated in navigation legislation, the Rivers and Harbors Act of 1899. *Section 13*, the so-called Refuse Act, forbade dumping into navigable waterways without a permit. To protect navigation, it gave the Army Engineers authority to regulate such dumping. *Section 10* of the 1899 legislation put a similar ban on the building of wharves, piers, bridges and bulkheads. It prohibited any change in the course or capacity of waterways without a permit from the Engineers. Anyone wishing to build or dredge or make any other change in a navigable waterway had to apply for a permit and obtain the approval of the District Engineer. The Division reviewed this action. Early legal interpretations held that the Refuse Act applied only to the protection of navigation not to the limitation of pollution.[1]

In the 1960s and 1970s, however, authorities transformed the Refuse Act from a navigational to an environmental law. This came about through a series of judicial rulings and by Congressional and Presidential action. In 1958, Congress required the Corps to consult conservation agencies before issuing Section 10 permits to dredge and fill. In the case of U.S. *v.* Republic Steel (1960) and U.S. *v.* Standard Oil (1966), the Supreme Court of the United States held that the Refuse Act forbade the dumping of all foreign substances and pollutants, except municipal sewage, into the Nation's waterways. As a result, in 1966, the Chief of Engineers placed environmental quality beside economic efficiency as a primary goal of the Corps. The following year, the Engineers began to employ the Section 10 permit power vigorously to prevent damage to fish and other wildlife as well as to protect navigation.

A series of events led to further expansion of the use of the 1899 law. Public concern about the environment increased after a massive oil spill off Santa Barbara, California, in 1969. In the spring of the following year, the finding of high levels of mercury in food fish led the Department of Justice to prosecute the largest mercury dumpers. They charged the dumpers with violation of the Refuse Act, the only pollution control legislation then available. The landmark case of Zabel *v.* Tabb in 1970 greatly expanded the Corps' authority under Section 13 to deny dredge and fill permits to prevent damage to fish and wildlife and interstate commerce dependent on the waterway. On December 23, 1970, President

Evolution of the Corps Regulatory Authorities

1899 *Enactment of the Rivers and Harbors Act of 1899*

Section 10	Corps of Engineers is given responsibility to regulate construction in navigable waterways.

Section 13	(Refuse Act) Corps is given regulatory responsibility over dumping into navigable waterways.

1972 *Enactment of Federal Water Pollution Control Act (FWPCA) Amendments of 1972*

Section 10 - 1899 Act	Unchanged

Section 404 - FWPCA	Corps if given responsibility over disposal of dredged or fill materials into U.S. waters.

Section 13 - 1899 Act	EPA assumes control over remaining dumping of materials into U.S. waters.

Richard M. Nixon issued a sweeping directive, ordering the Corps of Engineers to use its permit program under Section 13 to end pollution in the Nation's waterways. In cooperation with the Environmental Protection Agency (EPA), the Corps established a vigorous nation-wide enforcement program.

The North Atlantic Division pursued an energetic program of enforcement of antipollution law and improvement of the quality of the environment. In February 1970, the Division Engineer reported to the Chief of Engineers that some 16,700 inspections had been made, 118 warning letters issued, and 64 cases referred to U.S. Attorneys for prosecution. Fines in the amount of $34,600 had been imposed. Some 198 other cases remained pending. "It seems to me," the Division Engineer, Major General Charles M. Duke, concluded, "that this is an excellent demonstration of the Corps' effectiveness in the execution of our responsibilities in this area, although the newspaper headlines sometimes convey a different impression." The Chief of Engineers agreed.[2] Two months later, the Division Engineer reported that a fine of $6,250 had been made against a shipping company for an oil pollution violation by a tanker in Norfolk Harbor. It represented the largest single fine ever assessed in the North Atlantic Division.[3]

The passage of the Federal Water Pollution Control Act Amendments of 1972 gave the Nation a reorganized program. The new legislation set up an antipollution permit program under the Environmental Protection Agency rather than the Corps of Engineers. Although the Refuse Act continued to be a powerful anti-pollution law, it no longer included the *Section 13* permit program. The 1972 legislation, however, did not change the Corps' responsibility under *Section 10* of the 1899 Act. The Engineers retained the authority to preserve the integrity of navigation channels

through the regulation of construction work done in navigable channels and through the regulation of construction work done in navigable waters.

Furthermore, *Section 404* of the 1972 Act established a separate permit program administered by District Engineers for the disposal of dredged or fill materials into the waters of the United States. Upon application for disposal of such material, and after public hearings and review by the Division, District Engineers received authority to issue permits allowing such disposal at specified sites. The Corps selected the disposal areas in compliance with guidelines developed by EPA in conjunction with the Secretary of the Army. As with other Corps' programs, the Engineers increased decentralization of the permit programs within their organization.[4]

At mid-decade, a series of Federal court decisions further expanded the regulatory jurisdiction of the Engineers. In the 1974 case of U.S. *v.* Holland, a Federal Judge determined that Section 404 of the 1972 Act made mosquito canals and mangrove wetland areas in Florida subject to the Corps' regulation of dredging and filling operations. Responding to that decision, the North Atlantic Division Engineer became concerned about filling operations in an area of similar characteristics in the wetlands near Westhampton Beach, New York.[5] The Chief of Engineers replied that his office had only recently determined that the Corps' jurisdiction was limited to areas below the mean high water mark in tidal waters. The wetlands, which did not contain navigable waters, were not included.[6] Despite the Corps' reluctance to include such areas in its jurisdiction, a Federal Court in the District of Columbia ruled in March 1975 that the Federal Water Pollution Control Act required the Corps to regulate all "the waters of the United States." As worked out in the revised regulations in 1975, the Corps' authority under Section 404 extended to all coastal and inland navigable waters and continguous or adjacent coastal and freshwater wetlands, as well as tributaries of navigable waters up to their headwaters.[7]

NAD kept the Chief of Engineers abreast of developments in regard to the Corps' jurisdiction and its permit program. In June 1974, the Chief of Engineers, Lieutenant General W.C. Gribble, complimented the Division Engineer of NAD for his efforts. "As we launch into our new, revised emphasis on our permit program," he said, "it is good to learn that you are getting your District Engineers mobilized to submit reports on their individual findings of navigability."[8]

The North Atlantic Division was also responsible for Environmental Impact Statements (EIS). These were required by the National Environmental Policy Act of 1969, whenever a proposed activity or project would have significant impact upon the environment. The Districts and the Environmental Planning Branch of NAD's Planning Division prepared and reviewed such statements on both Corps' civil works projects and on other activities requiring Corps' permits. Draft and final impact statements proceed up the chain of command from the District through the Division to the Chief of Engineers and to the Council on Environmental Quality.[9]

A number of significant impact statements were prepared within the North Atlantic Division. One of the most extensive was a special Environmental and Ecological Impact Report on Hurricane AGNES of 1972. The Baltimore District contracted the Chesapeake Bay Research Council, the College of Marine Studies at the University of Delaware, and an independent engineering firm to conduct the investigation. The Engineers directed the contractors to focus on the environmental effects of the storm in the Chesapeake Bay, the Delaware Estuary, and flooded areas of New York, Maryland, Pennsylvania and Virginia.

Completed in 1974 and approved by NAD, the study concluded that Hurricane AGNES indeed had major effect upon terrestial, freshwater and estuarine ecosystems.

The catastrophic flooding caused a severe short-term drop in the salinity of Delaware and Chesapeake Bays because of the mammoth influx of fresh water. This had a number of effects on the estuarine habitat. It decimated oyster and clam fisheries and killed many juvenile blue crabs and weakfish. Damage in Chesapeake Bay alone was estimated at $18 million. The low salinity encouraged the spread of several types of fouling organisms such as rope grass, bryozoans and sea anemones. Algae or phytoplankton blooms

— the so-called "mahogany tides" — proliferated because of large quantities of phosphates and nitrates deposited in Chesapeake Bay by severe runoff. Unknown quantities of dangerous chemicals descended into the aquatic and marine habitats as a result of flood damage to pharmaceutical, chemical and industrial companies. High bacterial contamination and sewage pollution from raw and partially-treated sewage overflow into waterways led to the closing of many areas of Chesapeake Bay to shellfishing and swimming.

Despite these harmful results, several positive environmental effects stemmed from the catastrophe. The low salinity destroyed many oyster drills, which had been serious predators of oysters. In addition, the change killed MSX, a fungal parasite of oysters, Large numbers of sea nettles, commonly known as stinging jellyfish, and the polyps which produce them were similarly destroyed. The low salt content of the water also severely reduced populations of sponges and tunicates, called sea squirts, which were major fouling organisms.

The impact statement showed that the inland freshwater habitat and terrestrial habitat were affected by the storm. Fingerling and juvenile fish populations sustained major damage. The flooding and sedimentation displaced many adult fish. Consequently, sport fishing and related activities declined. Officials estimated the lost revenue at $20 to $80 million. Water quality was degraded in many areas from the overflow into streams and waterways of raw and partially-treated sewage, nitrates, and agricultural chemicals, and the accidental contamination with petrochemicals, pharmaceutical chemicals and industrial reagents. Extensive streambank and gully erosion occurred as well as massive flood plain scour and deposition.

The leaching or washing out of nitrates from the soil, due to large quantities of water filtering through the earth, left many flood plain lands with reduced nitrogen levels. This seriously affected agriculture in the area. Although the damage on the whole was minor, severe inundation in some areas caused fungal infections and root rot. Wildlife fatalities were widespread, but most birds and animals simply fled to higher ground.

This study of the environmental and ecological effects of Hurricane AGNES was one of the first studies made of the impact of catastrophic flood. Previous investigations had been limited primarily to the impact upon urban and agricultural areas. It represented a major new contribution to knowledge by NAD's Engineers.[10]

The North Atlantic Division reviewed the Environmental Impact Statements of its Districts and kept the Chief of Engineers informed on their status. One of the most controversial environmental impact statements and permit applications in the middle 1970s involved the application of the Hampton Roads Energy Company. The firm sought permission to build a petroleum refinery and marine terminal in Portsmouth, Virginia. The proposed refinery would eventually have a processing capacity of 250,000 barrels of crude oil per day. Although much local government and citizen support existed, public opinion became polarized on the issue as an organized opposition emerged. More than 1,000 persons attended a public hearing on the issue held by the Norfolk District. Changes in the company's proposals for discharging of the refinery effluent led to a number of reevaluations of the environmental impact. The District revised the Environmental Impact Statement and kept State and Federal Agencies abreast of the changes. The issue remained unresolved in 1975 and the Division Engineer continued to monitor the situation and the work of the District.[11]

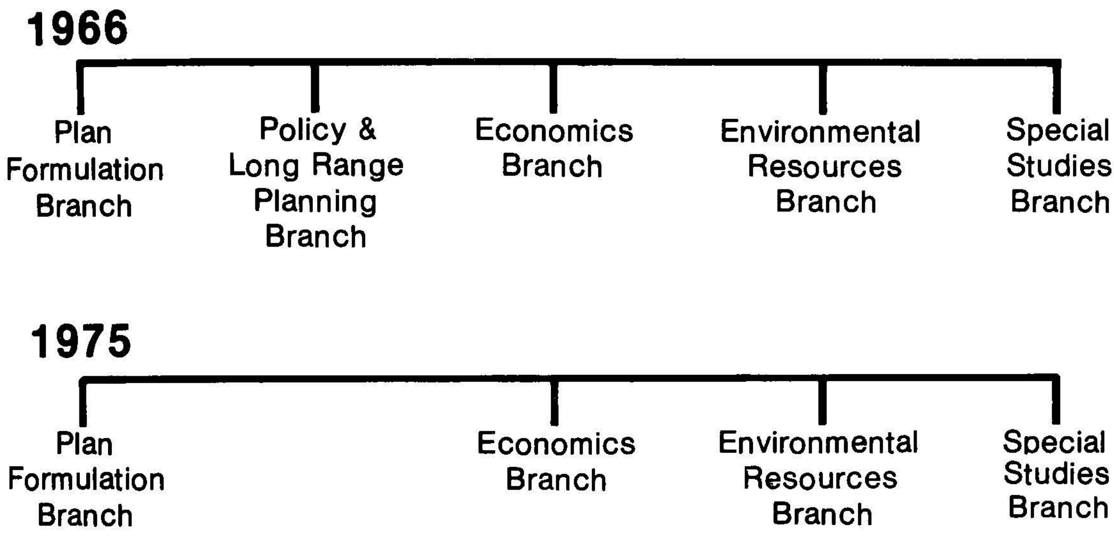
Thus in a number of important ways, the North Atlantic Division continued to play a significant role in protecting the environment and enforcing the new standards of water quality which the American people considered a necessary part of their standard of living.

II

Organization of a Planning Division

One of the most signficant developments in recent years in the North Atlantic Division has been the emphasis on long-range planning. Until the middle 1960s, the planning function was accomplished in NAD's Engineering Division. In 1966, NAD created a separate

Evolution of the Planning Division



Planning Division. As an indication of the priority and importance given to planning, the Chief of that unit received the same status as the Chief of the Engineering Division. Both were GS-16 level employees with grades equivalent to a brigadier general in the military service.

The independence and priority given to the Planning Division had several causes. The Office of the Chief of Engineers had been studying the role of planning for some time, but the passage of the Water Resources Planning Act of 1965 encouraged immediate action. The legislation provided for national and regional water planning by the Federal Government. It set up a Water Resources Council as a broad planning agency, the kind that had been proposed by several Presidents beginning with Theodore Roosevelt. The Chief of Engineers determined to provide the institutional framework for regional planning with the Corps. By directing each Division to create a separate Planning Division, he raised the position of the planning function within the Corps.[12]

The Planning Division performed several functions at NAD. It conducted long-range analysis, studying the needs of the region and the possible missions of NAD over the following one or two decades. The planners did regional studies, especially on the various water needs. And they did planning statements on other projects such as construction or dredging programs. The planners prepared survey reports and environmental impact statements. In short, they applied the skills of planners and engineers to the specific missions of the North Atlantic Division.[13]

III
Regional Planning Studies

Beginning in the mid-1960s, the Planning Division carried out some very important regional water resources studies. This type of study, which crossed local and state lines, and Corps' District and Division boundaries, became an important example of the unique capabilities of the North Atlantic Division.

There were some antecedents to the regional studies of the 1960s and 1970s. During the 1950s, the Division and the Districts had conducted a number of hurricane studies which assessed actual storm damage and recommended steps to reduce future destruction. In FY 1957, NAD had 22 specific local studies in this program. Over the next three years, they cost $885,000.[14] The Division also became involved in the New England-New York Inter-Agency Committee (NENYIAC) Study. This study, completed in 1955, represented an early example of Federal-state-local cooperation in developing regional water policy. The NAD Division Engineer served as chairman of NENYIAC. In this position, he coordinated the work of a group which included representatives of the U.S. Departments of Agriculture, Army, Commerce, Interior and State, the Federal Power Commission and the Federal Security Agency, as well as representatives from each New England state and New York. Furthermore, NAD conducted Basin Studies of the Potomac and Delaware Basin and of Chesapeake Bay. The latter involved the construction of a $15 million hydraulic working model of Chesapeake Bay. Built at Matapeake, Maryland, at the terminus of the Annapolis Bridge, the model proved extremely valuable for the study of the area.

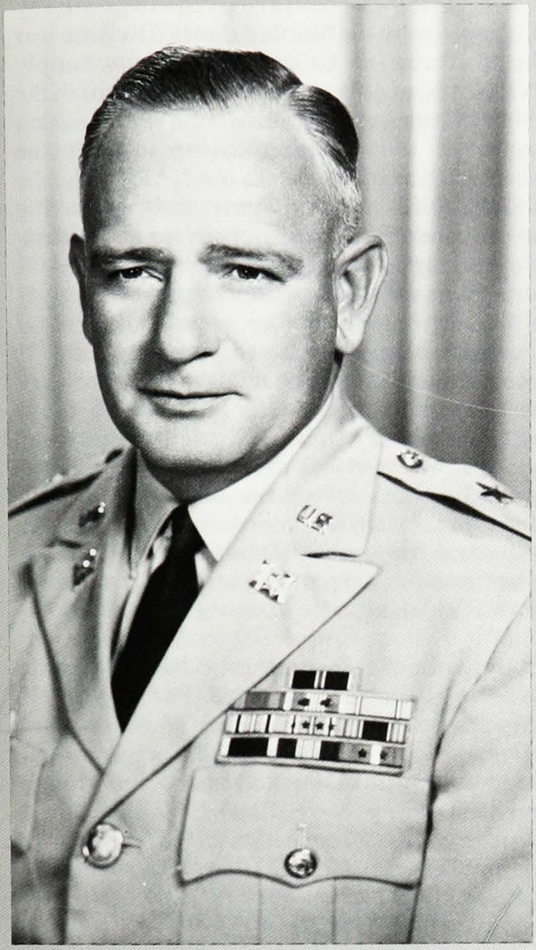
The first major regional study under the newly-established Planning Division was the North Atlantic Regional Water Resources (NAR) Study. Authorized by Congress in 1966, NAR provided a comprehensive, multi-agency survey of the water resources and needs of the Northeast over the next 50 years. It had been triggered by the drought of early 1960s and by the passage of the Water Resources Planning Act of 1965.

The task proved enormous. The Engineers had to study and project the water needs for 50 years for a region which encompassed 13 states and 26 per cent of the American population. Congress had not defined the method of coordinating such a study. It had left the participants to establish the lines of authority, the degree of cooperation, and the leadership among the welter of Federal, State and local agencies.

The North Atlantic Division was assigned significant leadership in carrying out the NAR Study. It helped achieve the cooperation of the various agencies and the constituencies involved. The others recognized that NAD was one of the few existing agencies which was familiar with the region's water resources. Brigadier General David S. Parker, the Division Engineer when NAD first received the assignment, later recalled:

> The water supply studies on a regional basis were initiated during my tenure. I believe we were rather successful in setting the stage for these studies when we held the first regional conference with representatives of a number of government agencies. We managed to get agreement that the Corps of Engineers would provide the basic leadership for the study program.[16]

His successor, Brigadier General F. P. Koisch, continued to implement the program. Between 1966 and 1968 General Koisch, accompanied by a small group from NAD, held meetings with officials and with the public from Maine to Virginia.



Major General Francis P. Koisch, Division Engineer, North Atlantic Division, 1966-1968.

Biographical Sketch

Major General Francis P. Koisch

Division Engineer, 1966-1968

General Koisch illustrated the continued high standards and broad career background that characterized NAD Division Engineers. He was graduated from the U.S. Military Academy in 1942. During World War II, he served with the Engineer Section, Eighth U.S. Army in the South Pacific, the Philippines, and Japan.

Returning to the United States after the war, Koisch served as Deputy District Engineer of the Philadelphia District. He then was assigned as Area Engineer in Keflavick, Iceland. Subsequently, he served as Commander, 79th Engineer Group, Fort Belvoir, Virginia and as Deputy Director for Military Construction in the Office of the Chief of Engineers in Washington, D.C. His next assignment made him famous within the Corps. As the Fort Worth (Texas) District Engineer, General Koisch had the responsibility for administering the design and construction of the National Aeronautics and Space Administration's Manned Spacecraft Center at Houston. He became known as the man who built the Spacecraft Center.

After that task, General Koisch went to a top-level position as Special Assistant to the Commanding General, U.S. Army, Vietnam.

Between 1966 and 1968, as a Major General, he served as the Division Engineer of the North Atlantic Division.

After his service with NAD, General Koisch received a number of other major assignments. He became the Director of Civil Works in the Office of the Chief of Engineers. Subsequently, he served as the Engineer, at Headquarters, U.S. Army, Europe, Seventh U.S. Army in Heidelberg, Germany. In 1974, he received an appointment as Division Engineer of the Lower Mississippi Valley Division and President of the Mississippi River Commission. In that position, General Koisch supervised and directed a major national water resource construction program of flood control and navigation projects pertaining to the lower Mississippi Valley in parts of eight states.

In addition to his Bachelor's degree from the U.S. Military Academy, General Koisch received a Master of Science degree in Civil Engineering from the University of California at Berkeley. He is a graduate of the U.S. Army Command and General Staff College and of the U.S. Army War College.[17]

The North Atlantic Regional Water Resources Study, which General Koisch headed while NAD's Division Engineer, represented a complex, multiagency survey. Its members organized a Coordinating Committee in 1966 to guide the study. The committee included representatives of the Federal Departments of the Army; Agriculture; Health, Education and Welfare; the Interior; Transportation; Housing and Urban Development; and Commerce. It also had representatives from the Federal Power Commission, the Delaware River Basin Commission, the Environmental Protection Agency, and the New England River Basins Commission. In addition, Committee members came from each of the 13 states in the NAR area and from the District of Columbia. General Koisch chaired the group.

The water problems of the North Atlantic Region were outlined in November 1967 in a speech by Burnham H. Dodge, then chief of NAD's Planning Division. Within 50 years, the population of the area was expected to double to over 100 million persons. Water and power demands of the region would also double in that period. By 2020, the amount of fresh water needed would be more than the average yearly runoff. Clearly more water sources would be required.[18]

The NAR Study Team completed their final report in 1972 at a cost of $4.5 million. The study considered three objectives: regional development, national income, and environmental quality. During the six years, the planners analyzed plans for various means of providing water, power, and other resources needed to maintain economic growth and the quality of the water. Among their proposals were plans for storing water in reservoirs, developing new wells, preparing desalinization plants, and arranging for inter-basin transfers of water. They also analyzed proposals for navigation, waste treatment, production of hydroelectric power, reduction of flood damage, control of beach erosion, and maintenance of water recreation and fish and wildlife preserves. Using an enormous amount of data as well as computer-programming, the planners had amassed information which would enable decision-makers in the region to manage the water and related land resources in the interest of the people of the North Atlantic Region for decades to come.[19]

A related regional planning survey undertaken by the North Atlantic Division was the Northeastern United States Water Supply (NEWS) Study. As a result of the drought in the 1960s, Congress authorized the study which began in 1966. Encompassing roughly the same geographical area as the NAR Study, the NEWS Study focuses more sharply on the present and immediately projected water needs of municipalities in the area. Designed to present a regional assessment of water supply problems, NEWS was an ongoing study and was still being developed a decade later. It offered plans for major reservoirs, conveyance facilities, and treatment plants which could supplement or link individual city water systems. The aim was to develop a coordinated general plan for essential water supply development in the Northeast. It sought to provide a framework through which Federal, State, and local agencies could work together toward securing adequate water supplies.

As in the NAR Study, the North Atlantic Division directed the NEWS Survey. It encouraged the participation of government agencies and public and private organizations involved in water supply. The task was a major one, involving long-range planning for a rapidly growing region. As Division Engineer Major General Richard Groves explained to the Delaware River Basin Water Resources Conference in October 1973:

> As a first step in dealing with the problems of the Northeast, we must fix our position on the scale of time. We have to understand that the solutions to 20-years-hence problems are being pre-determined today—especially those involving large public works... That's how long it takes our Planning-Programming-Budgeting-Construction cycle to move from its inception to its end. . . .Visualize, if you can, how our country's laws, and our people's attitudes which they reflect, have changed in the 20 years just passed. The projects we are completing now were formulated to reflect attitudes and laws stemming from the Great Depression and World War II. Today those attitudes and laws have changed in many respects, and so has the way in which we conduct our business. Yet, although we cannot but

wonder what the American people of 1993 will think our work, we must get on with that work as best we can because our ability to influence our situation in the 1990s for good is fast slipping away from us.[20]

Working on that basis, the NEWS study established priorities for problem areas. In these areas, projected demand for water supply by 1980 was seen as exceeding the capabilities of the systems serving them in the early 1970s. Included in this category were the Eastern Massachusetts-Rhode Island Area, the Northern New Jersey-New York City-Western Connecticut Metropolitan Area, and Metropolitan Washington, D. C. By the mid-1970s, the study team in the New York Metropolitan Area had compiled a substantial data base. It defined water demands to be met, developed alternative projects and programs, and made impact assessments and evaluations. NAD planners expected to complete their report recommending a water supply program for the New York Metropolitan Area and send it to Congress in 1977.[21]

In contrast to NAR and NEWS, some other studies done at NAD and in the Districts represented part of nationwide projects by the Corps of Engineers. The National Shoreline Study provides an example. In 1968, Congress directed the Corps to study the 37,000 miles of shore and coastline, including 1,090 miles along the North Atlantic Coast. The Engineers completed the study in 1973. They supplied information on shore erosion, land use and ownership, guidelines for shore management and protection, and order-of-magnitude estimates of the cost of controlling erosion. In the North Atlantic Region, the Districts gathered the data and the Planning Division at NAD assembled and integrated it into a regional report.

The Corps recommended measures to halt erosion at 2,700 miles of shoreline, including the entire North Atlantic Coast, in order to prevent widespread loss of land and other property. The Engineers estimated the cost at $1.8 billion. To study means of implementing the Corps' recommendations for controlling beach erosion, Congress authorized a few small projects. Within the North Atlantic Division area, all of these were located in the state of Delaware. They included monitoring projects on the beaches at Bowers, Lewes, and Broadkill and the construction and observation of various devices such as breakwaters at Pickering Beach and Kittshumork Beach.[22]

The North Atlantic Coast Deep Water Port Facilities Study represented another major study. This survey of the coastal area from Maine to Virginia was conducted by the Philadelphia District under NAD's supervision. In 1971, Congress authorized funds for surveys in three regions of the United States to determine the most efficient means of developing offshore facilities for the new supertankers which had been built since the 1960s. These massive vessels had drafts of 75 to 100 feet when fully laden. They could not clear the interior channels of most American ports until they had been lightered by transferring most of their oil to smaller craft.

The Engineers studied the problem. Philadelphia District held a dozen public hearings. Since oil would continue to be the major energy source for the North Atlantic Region until at least the end of the century and since most of it would be imported by ship, the Engineers concluded that there was a real need for a deepwater offshore port for super-tankers. A single-point mooring buoy system perhaps a dozen miles off the coast could carry the crude oil through pipelines to refineries in New York, New Jersey, and Pennsylvania. The Division Engineer testified before a Congressional committee that the danger to the environment was greater in the current system of lightering from supertankers to smaller craft than it would be in using a single mooring-buoy system under strict licensing and monitoring control. Nevertheless, when many local residents near the proposed deepwater sites protested, a number of States passed laws prohibiting such ports.[23]

The most recent series of studies begun by NAD and its Districts came under the Urban Studies Program initiated by the Corps in 1972. For years, river basins had been the Army Engineers' basic planning units. But recently, the Corps turned its planning capabilities to metropolitan areas to help solve their urban water and related land resource problems.

By the late 1960s, for example, old methods of managing urban sewage treatment had proven inadequate. Between 1956 and 1970, more than $6.2 billion had been expended for such treatment plants in the United States.

Nevertheless, pollution increased in rivers, lakes, and harbors. The fragmented approach of treating sewage on a community-by-community basis hampered effective action. The decentralized structure of the Corps of Engineers could span existing political boundaries. Taking advantage of this, Congress in 1971 authorized the Corps to undertake pilot studies in six regional areas. It directed the Engineers to investigate alternatives for wastewater management in cooperation with the Environmental Protection Agency and State and local governments.

NAD supervised a number of these pilot projects in the North Atlantic Region. A study of one of the first, the Codorus Creek Basin in York County, Pennsylvania, had been completed by 1974. Congress added the Chester Creek Basin in Pennsylvania, Christina River Basin near Wilmington, Delaware, and the Binghamton, New York area in 1973. The Housatonic Basin in Connecticut and the Camden, New Jersey metropolitan area were included in 1974.

These Urban Studies sought to help local areas and regions meet the national water quality goals established by the Federal Water Pollution Control Act Amendments of 1972. District and Division Planning offices with NAD studied a variety of urban water concerns: urban flood control, flood plain management, urban water supply, wastewater management, regional harbor and waterway needs, bank and channel stabilization, recreation, and lake, ocean, and estuarine protection.

The Camden, New Jersey, metropolitan area offers one example. The area consists of 140 square miles and nearly one million inhabitants. The Engineers began an Urban Studies Program there in 1974. They examined the problems of wastewater management and urban flooding. As the NAD Division Engineer explained to a House Committee in 1974, the Engineers sought to develop alternative plans to solve those problems. Those plans could be implemented subsequently by local interests through Corps of Engineers' projects or through EPA's wastewater facilities grants.[24]

IV

A Variety of Projects

The North Atlantic Division received responsibility for several new short-term programs in the mid-20th Century decades. These involved the Army Reserves, the U.S. Postal Service, and Civil Defense.

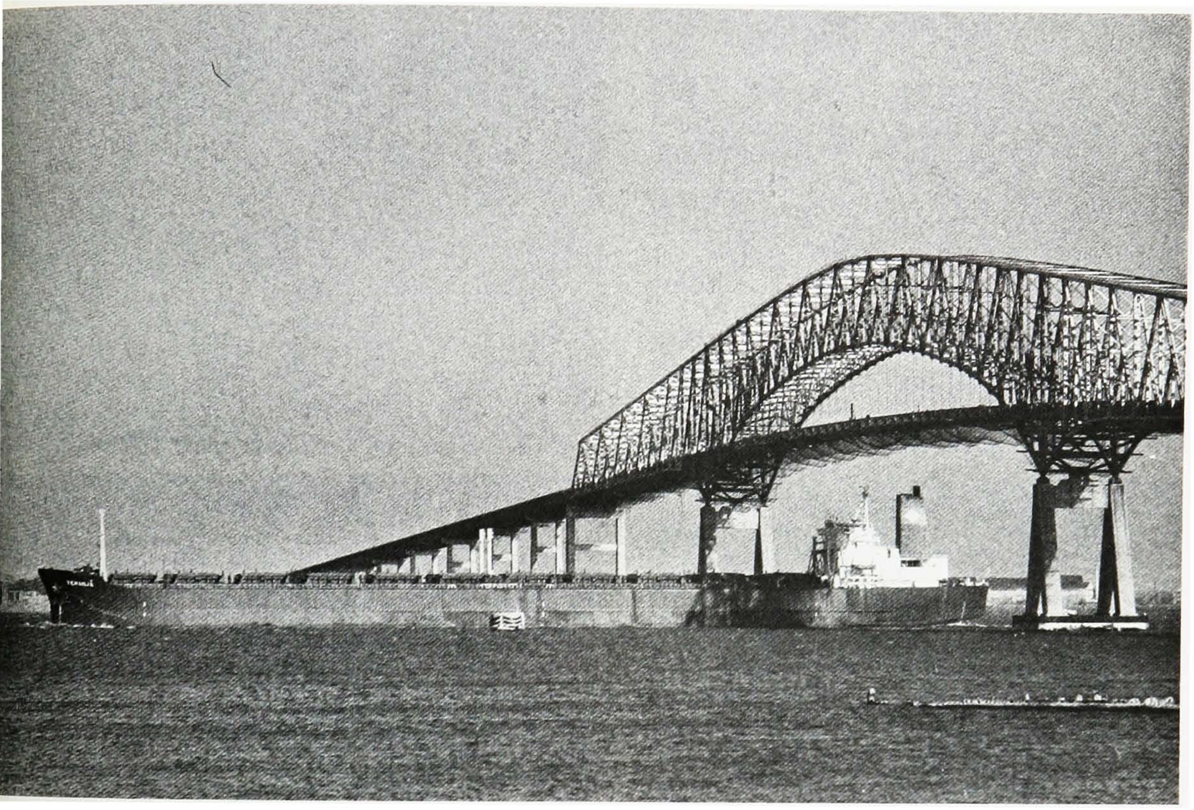
Civil Defense

NAD's Civil Defense Support Program represented a significant new activity. Following the development of Intercontinental Ballistic Missiles, the Kennedy Administration began an extensive effort to provide shelters for defense against nuclear attack. Commencing in 1961, NAD's Engineering Division provided technical supervision over 10 field offices included in the program. In November 1968, realignment of individual area assignments reduced the number of NAD field offices to five. The overall program in the North Atlantic Region encompassed six states from New York to Virginia. The 50 million persons in that area represented one-quarter of the American population.

NAD's Civil Defense Support Program had several components, most significantly the Fallout Shelter Survey. It located 81 million shelter spaces in existing buildings and marked them with shelter signs. The Engineers completed the basic survey, which cost about $20 million, in 1964 and updated it thereafter on an annual basis. The survey which had identified the best available protection against nuclear weapons blast and radiation, was expanded in 1973 to include protection against windstorm, earthquakes, floods, and hurricanes.

Other, smaller components of the Civil Preparedness Support Activities existed within NAD. The Emergency Broadcast Protection Program provided for protected areas and auxiliary power and program equipment at selected radio stations. About 84 stations completed the required work by 1975. In the Community Shelter Planning Program, Army Engineers in the NAD region awarded 48 contracts to develop and evaluate community shelter plans. Additionally, NAD established a support unit composed of three qualified

Giant Supertankers Create New Problems for Harbors.



engineers at the Civil Defense headquarters of Region II at Olney, Maryland. The unit provided technical assistance, advice, and engineering services to the Regional Director, particularly in support of the Emergency Operating Center Program. In the 1970's, the Engineers constructed at Olney a permanent underground, protected facility to serve Region II as a command post for conducting emergency operations as well as normal day-to-day operations. The total cost of all the engineering work in NAD on the Civil Defense and Preparedness Support Programs between 1961 and 1975 amounted to approximately $50 million.[25]

Postal Service Construction

The construction of postal facilities in the region represented a major new assignment for NAD. In the late 1960s, the Government decided to improve the Nation's mail service. The Post Office Department's reliance upon hand-sorted and hand-delivered mail had made it unable to cope with the rapidly increasing volume of mail. Officials worried about the possibility of a partial or even total breakdown of postal operations. Postmaster Winton M. Blount and others advocated modernization of the mail system through widespread mechanization. As a result,

Congress in 1970 reorganized the Post Office Department as a public corporation, the U.S. Postal Service, and gave it the authority to sell $10 billion in bonds to raise funds for modernization. It also approved a massive construction effort designed to speed the handling of all types of mail.[26]

Top, Near Right. Bulk Mail Center Conveyor Line, Washington, DC.

Upper Center, Near Right. Bulk Mail Center, Philadelphia, Pennsylvania.

Lower Center, Near Right. Aerial View, Dalecarlia Water Filtration Plant, Washington, DC.

Bottom, Near Right. Family Housing, Natick Laboratories, Massachusetts.

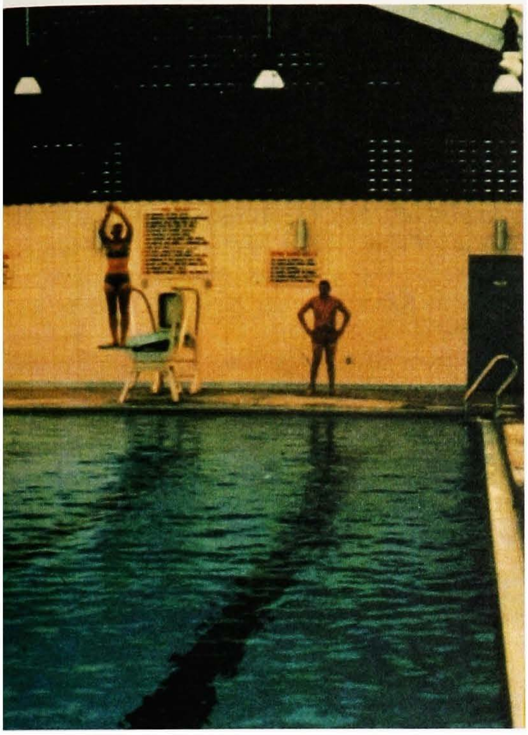
Top, Middle Right. Swimming Pool, Fort Devens, Massachusetts.

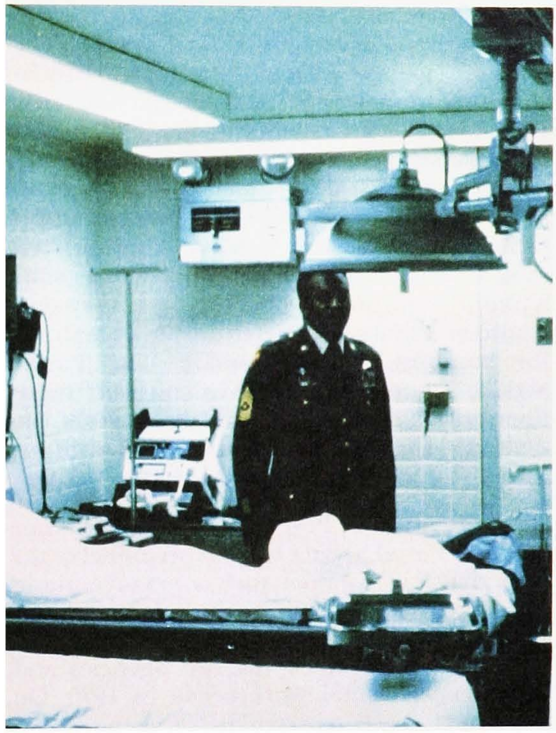
Center, Middle Right. Administration Building, Radford Army Ammunition Plant, Virginia.

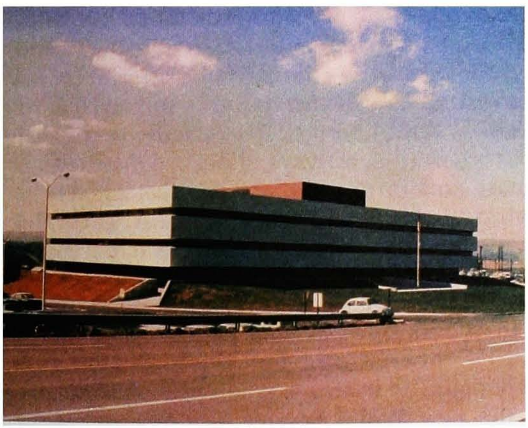
Bottom Middle Right. U.S. Army Reserve Center, Fort Belvoir, Virginia.

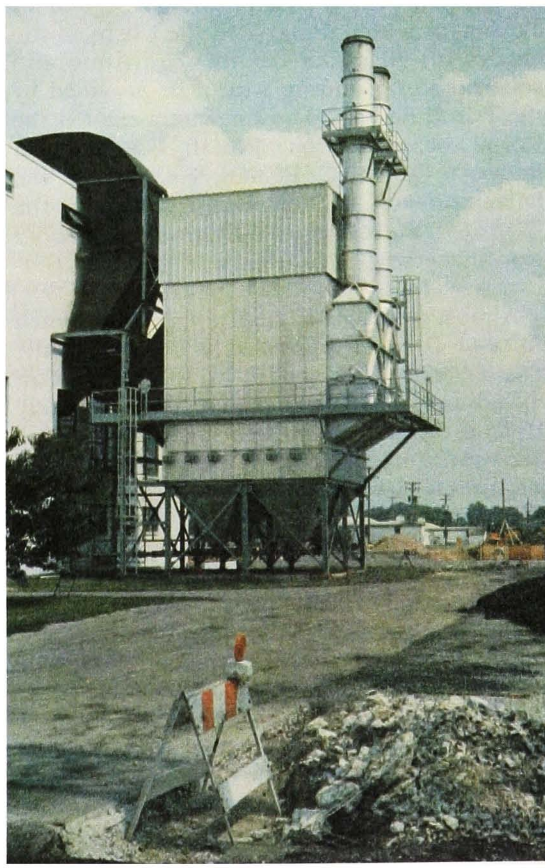
Top, Far Right. Emergency Room, McDonald Hospital, Fort Eustis, Virginia.

Bottom, Far Right. Boiler Plant Precipitator, Wright Patterson Air Force Base, Ohio.









The keystone of the modernization program was the creation of a Bulk Mail System. The old Post Offices had been located primarily in congested downtown urban areas. The new Bulk Mail Facilities would consist of several large physical plants built on the periphery of urban centers, near interstate highways, airports, and other modern transportation facilities. They would use computerized mechanization and other high-speed mail handling equipment. Backing up this system would be a series of Preferential Mail Facilities for handling non-bulk mail. The Postal Service wanted to renovate or construct more than 100 facilities within three years. It estimated the cost at more than $750 million.

Neither the old Post Office Department nor the new Postal Service had the personnel or the experience to conduct such a massive, rapid construction program. As a result, the Postal Service turned to the Corps of Engineers. Negotiations between the two agencies and some experimental work began in 1970. On March 11, 1971, representatives of the Postal Service and the Corps of Engineers signed an agreement which designated the Corps as the agency for all postal facility acquisition and construction. Funding would be provided by the Postal Service. The Engineers created the Corps of Engineers Postal Construction Support Office (CEPCSO). As part of the Directorate of Military Construction in the Office of the Chief of Engineers, CEPCSO would oversee the construction program.[27]

Almost from the beginning, the North Atlantic Division played an active role in the Postal Service Program. In 1971, NAD took on the administration of design of approximately 10 facilities with a construction cost of some $120 million. In 1972, it added another 10 facilities with a cost in excess of $150 million. Foreseeing this expansion, the Division Engineer in 1970 had proposed that the NAD design effort be undertaken by the New York and Norfolk Districts because of the already heavy workloads of the Philadelphia and Baltimore Districts. This two-District concept allowed each District to add a moderate increase in staff for the initial workload. It allowed a degree of flexibility in staffing to accommodate additional work as it developed.[28] Subsequently, the majority of the Postal Service construction in the region was handled by the New York and Norfolk Districts as the Division Engineer had recommended.

Even while the negotiations continued, NAD became involved in the real estate acquisition, design, and construction of postal facilities. The Postal Service gave the Corps authority to take over some projects before the signing of the overall agreement. The largest of these initial projects was the bulk mail facility at Kearney, near Newark, New Jersey. The New York District assisted in the completion of the facility and studied the installation of mechanized equipment in order to gain experience and knowledge about the modernization program.[29] Later, the New York District and the North Atlantic Division joined a few selected units involved in the design process for the entire program.[30]

The North Atlantic Division participated actively in the Corps' construction of postal facilities. It supervised work at a number of major bulk mail facilities including those at Secaucus, New Jersey, near New York City; northeastern Philadelphia; and in Largo, Maryland, near Washington, D.C. By mid-1972, in a further decentralization of small and regional facilities, the Division Engineer was authorized to execute requests for services by the U.S. Postal Service Regions involving real estate activities, surveys, design, construction, repair and improvements projects as well as technical services. To carry on this work, the Division and its Districts added nearly 200 new members to their staffs. Major postal construction or renovation projects — more than 200 in all — existed in every state under NAD's supervision. The Division's area of responsibility in this was contagious with that of the new Postal Service Regions and more closely approximated NAD's military construction area than its civil works territory.[31]

The involvement of the Division began to end in 1973 when the Office of Management and Budget ordered the Corps of Engineers to disengage itself from the postal support mission. In the surprise decision of January 1973, OMB ordered the postal facilities returned to the Postal Service as rapidly as possible. By mid-1974, the Corps had spent $617 million on the program. Nine bulk mail centers had been completed and dozens of smaller facilities erected or renovated. In May 1975, the Division Engineer reported that the

Washington, D.C. Bulk Mail Center had been transferred to the Postal Service and that the Philadelphia and Secaucus Bulk Mail Centers would be completed by the end of the year. The Acting Chief of Engineers hailed this news as "another welcome milestone in our execution of the Bulk Mail Program."[32] Thus the five-year program of the Division in the modernization of postal facilities came to a successful conclusion.

The Army Reserve Program

Construction of training centers and other facilities for the U.S. Army Reserve served as a continuing mission of the North Atlantic Division during the post-World War II period. However, it grew dramatically in the 1970s. With the termination of the military draft and the turn to an All-Volunteer Armed Force, the Defense Department launched a major program to upgrade facilities for the Reserves. The Office of the Chief of Army Reserves on the General Staff selected and funded the projects, but the Engineer Districts handled actual design and construction.

Within the North Atlantic Division, the modernization program in the 1970s averaged more than a dozen projects a year. Expenditure ran about $20 million annually. The three military construction districts — New York, Baltimore, and Norfolk — were all involved, under NAD's review and coordination.

Construction projects varied. Most common were the Army Reserve training centers, one- to two-story structures, similar in appearance to schools. Most of them inlcuded classrooms, assembly halls, and storage facilities, but the layout and equipment varied, depending upon the nature of the Reserve unit. Medical units needed laboratories; data processing units needed computers; armored and engineering units needed other facilities. Many had indoor firing ranges. With such a variety of functions, standardization proved impossible and each building had to be tailored to its using service. Costs ranged from $200,000 for small expansion projects to $10 million for a 2,400-man training center proposed for Fort Totten in New York City. A great deal of community interest in the training centers existed because of their visibility and their community-centered orientation.[33]

The Engineers also constructed a number of outdoor training facilities. Tank trails, ammunition storage magazines, and pop-up firing ranges were built at Fort Drum, New York, Forts Pickett and A.P. Hill in Virginia and Fort Indiantown Gap in Pennsylvania. In addition, the Engineers erected hangars and flight simulator buildings for the Army's aviation units. The Division played a major part in upgrading the facilities of the Army Reserves in the 1970s.

V

Conclusion

In the recent past, the public became aware of threats to the environment caused by urban and industrial growth. As a result, a new insistence emerged for a balance between the traditional goal of prosperity and the new desire to protect the environment and conserve resources. Many matters, such as community planning and pollution control, had been previously handled by local agencies. These now came to involve regional and national agencies. As an established organization with effective national, regional, and local units, the Corps of Engineers received increased regulatory and planning authority to help pursue these goals.

The North Atlantic Division was given responsibility for supervising these missions on the regional level. It could cut across the numerous political subdivisions which had hampered effective planning and action in so many areas. As in the past, it usually acted through cooperation rather than coercion. It provided leadership and contributed Federal funding to these efforts. Usually its organizational framework proved adequate to the task. When it did not, NAD created new organizational elements, like the Planning Division, to raise its capability in these areas.

By responding to the new public concerns — the environment, urban problems, and regional planning — the Division proved that it could perform valuable functions in a changing society. The North Atlantic Region also benefited. It received NAD's considerable skills, its ability to deal with intercommunity and interstate problems, and its Federally-funded programs. Once again, the Army Engineers showed that they could assist the region achieve its goals, even as these changed with changing times.

FOOTNOTES

— CHAPTER 1

Early Years of the Army Engineers in the Northeast, 1775-1888

1. See, for example, L. Prague deCamp, *The Ancient Engineers* (Cambridge, Mass., 1960); B. Gille, *The Renaissance Engineers* (London, 1966); R. J. Forbes, *Man the Maker: A History of Technology and Engineering* (London, 1958); Vezio Melegari, *Great Military Sieges* (N.Y., 1972); John A Miller, *Master Builders of Sixty Centuries* (Freeport, N.Y., 1972); and Robert J. Unstead, *Castles* (London, 1970).

2. Institution of Royal Engineers, *The History of the Corps of Royal Engineers* (9 vols., London, 1889-1958); E.W.C. Sandes, *The Royal Engineers in Egypt and the Sudan* (London, 1937).

3. Raleigh B. Buzzaird, "America's First Chief Engineer," *The Military Engineer*, XXXIX (December, 1947), pp. 505-510, XL (March, 1948), pp. 115-118; Robert R. Ellis, "Richard Gridley: First Chief Engineer of the Army," *The Military Engineer*, LV (1963), pp. 157-160, 265-268, 344-347.

4. W. F. Heavey, "The Corps in the Days of the Revolution," *The Military Engineer*, XXXI (November-December, 1939), pp. 410-415; E.S. Kite, *Brigadier General Louis le Beque du Portail* (Baltimore, 1933)

5. Secretary of War Henry Dearborn to Decius Wadsworth, June 21, 1803 Records of the Corps of Engineers (Record Group 77), No. 58510/41, National Archives, Washington, D.C.

6. Stephen E. Ambrose, *Duty, Honor, Country: A History of West Point* (Baltimore, 1966); W.H.G. Armytage, *A Social History of Engineering* (Cambridge, Mass., 1961); R. Ernest Dupuy, *Men of West Point: The First 150 Years of the United States Military Academy* (N.Y., 1951).

7. The most valuable recent history is Emanual Raymond Lewis, *Seacoast Fortifications of the United States: An Introductory History* (Washington, D.C., 1970). Much information is also contained in E. E. Winslow, "Lectures on Seacoast Defense," *Occasional Papers of the Engineer School, No. 35* (Washington, D.C., 1909), U.S. Army, Chief of Engineers, *Annual Report, 1886* (Washington, D.C., 1886), pp. 5-48; Robert Arthur "Early Coast Fortification," *The Military Engineer*, LIII (July-August, 1961), pp. 279-280; John M. Hammond, *Quaint and Historic Forts of North America* (Philadelphia, 1915); and Bruce Grant, *American Forts: Yesterday and Today* (N.Y., 1965).

8. Henry C. Jewett, "History of the Corps of Engineers to 1915," *The Military Engineer* (September-October and November-December, 1922); Thomas H. Rees and G. A. Youngberg, "History of Engineer Troops in the United States Army, 1775-1901," *Occasional Papers of the Engineer School, No. 37* (Washington, D.C., 1910); Oliver L. Spaulding, *The United States Army in War and Peace* (N.Y., 1937); Russell F. Weigley, *History of the United States Army* (N.Y. 1967).

9. Secretary of War James McHenry, January 31, 1800 quoted in U. S., *American State Papers, Military* (38 vols., Washington, D.C., 1832-1861).

10. Forest G. R. Hill, *Rails and Waterways: The Army Engineers and Early Transportation* (Norman, Okla. 1957); Carter Goodrich, *Government Promotion of American Canals and Railroads, 1800-1890* (N.Y., 1960); Stuart Bruchey, *The Roots of American Economic Growth, 1607-1861* (N.Y., 1965); G. R. Taylor, *The Transportation Revolution, 1815-1860* (N.Y., 1951).

11. Secretary of War John C. Calhoun, Report to the President, Dec. 3, 1824, reprinted in *American State Papers, Military*, II, pp. 699-701.

12. "Report of the Board of Engineers on the Defense of the Seaboard," 1821 in *American State Papers, Military*, II, pp. 304-313.

13. U.S., *Statutes at Large*, IV, 22, approved April 30, 1824; Leland R. Johnson, "19th Century Engineering: The Contract of 1824" *The Military Engineer*, LXV (1973) pp. 166-174, 252-257.

14. U.S. Army Corps of Engineers, *Genesis of the Corps of Engineers* (Fort Belvoir, Va., 1966); and *History and Traditions of the Corps of Engineers* (Fort Belvoir, Va., 1953).

15. George L. Vose, *A Sketch of the Life and Works of George W. Whistler, Civil Engineer* (Boston 1887); Carlisle Allan, "George W. Whistler, Military Engineer." *The Military Engineer* XXIX (1937) pp. 177-180.

16. D. H. Calhoun, *The Amercian Civil Engineer* (N.Y., 1960).

17. This section is based particularly upon material in Lewis, *Seacoast Fortifications of the U.S.*; Corps of Engineers, *Genesis of the Corps and History and Traditions of the Corps*; Weigley, *History of the Army*; William A. Ganoe, *The History of the United States Army* (N.Y., 1924); L. D. Ingersoll, *History of the War Department* (Washington, D.C. 1879); Jack Coggins, *Arms and Equipment of the Civil War* (N.Y., 1962); and Gilbert Thompson, "The Engineer Battalion in the Civil War, "*Occasional Papers of the Engineer School, No. 44* (Washington, D.C., 1910).

18. The following section drew upon these works: A. M. Humphreys, "Historical Sketch of the Corps of Engineers," in U.S. Congress, Senate, *Report No. 555*, 45th Cong, 3d Sess., pp. 327-353; W. Stull Holt, *The Office of the Chief of Engineers of the Army: Its Non-Military History, Activities, and Organization* (Baltimore, 1923); Harold Kelso, "Inland Waterways Policy in the United States," doctoral dissertation, University of Wisconsin, 1942; Isaac Lippincott, "A History of River Improvement," *Journal of Political Economy*, XXII (1914), pp. 630-660; Edward L. Pross, "History of Rivers and Harbors Appropriation Bills, 1866-1933," doctoral dissertation, Ohio State University, 1938; Lester F. Simon, *Dredging Engineering* (N.Y., 1920); Frank E. Smith, ed., *Conservation in the United States: A Documentary History* (2 vols., N.Y., 1971); and U.S. Army Corps of Engineers, Records of the Corps of Engineers (RG 77), National Archives, Document File, 1894-1923, Box 1209, File No. 50734-72 which contained information on the history of the Corps of Engineers.

— CHAPTER 2

The Division Emerges, 1888-1919

1. George W. Cullum, *Biographical Register of Officers and Graduates of the U.S. Military Academy* (3rd ed., N.Y., 1891), II, pp. 367-370, 520-521.

2. U.S. Army, Chief of Engineers, General Order No. 93, Nov. 8, 1888. This and all other General Orders hereinafter referred to may be found in the bound annual volumes of General Orders of the Chief of Engineers located in the Library of the Office of the Chief of Engineers, Washington, D.C.

3. U.S. Army, Chief of Engineers, General Orders December 3, 1888; July 24, 1901; March 31, 1903; December 5, 1903; April 6, 1907; May 28, 1907; February 15, 1908; June 13, 1913; June 26, 1913. W. Stull Holt, *The Office of the Chief of Engineers* (Baltimore, 1923), pp. 93-94.

4. Biographical data from Cullum's *Biographical Directory; The National Cyclopaedia of American Biography, Who's Who in America*, "Brigadier General Henry Larcom Abbot," typescript, April 12, 1943, in Historical Division, Office of the Chief of Engineers, Baltimore, Maryland; Robert W. Sawyer, "Henry Larcom Abbot — and Pacific Railroad Surveys in Oregon, 1855," *Oregon Historical Quarterly* (March-June, 1932); and General Abbot's numerous publications including *Pacific Railroad Reports* (1857); with Captain A. A. Humphreys, *Physics and Hydraulics of the Mississippi* (1861); *Siege Artillery in the Campaign against Richmond* (1867); *Experiments and Investigations to Develop a System of Submarine Mines for Defending Harbors of the United States* (1881); and *Problems of the Panama Canal* (1905).

5. Colonel H. L. Abbot to Chief of Engineers, October 27, 1890, Northeast Division Letterbooks, Records of the Corps of Engineers (RG 77). See also Colonel W. M. Black to Captain A. E. Waldron, December 9, 1911 in *ibid.*

6. Colonel A. Stickney to Brigadier General G. L. Gillespie, December 19, 1903; Eastern Division Letterbooks, Records of the Corps of Engineers (RG 77).

7. Colonel A. Stickney to Brigadier General A. MacKenzie, August 31, 1904, in Northeast Division Letterbooks, Records of the Corps of Engineers (RG 77).

8. Colonel J. M. Wilson to Brigadier General W. P. Craighill, October 31, 1895 and Wilson to Major W. H. Adams, February 6, 1896, both in Northeast Division Letterbooks, Records of the Corps of Engineers (RG 77).

9. Colonel C. R. Suter to Major G. W. Goethals, October 10, 1902, Northeast Division Letterbooks, Records of the Corps of Engineers (RG 77).

10. Colonel H. L. Abbot to Brigadier General T. L. Casey, November 11, 1893, in *ibid.*

11. Colonel S. M. Mansfield to Brigadier General A. MacKenzie, August 31, 1904, in *ibid.*

13. *Ibid.*

14. U.S. Bureau of the Census, *Statistical History of the United States* (rev. ed., Stamford, Conn., 1965), pp. 452-455; Richard W. Barsness, "Maritime Activity and Port Development in the United States since 1900: A Survey," *Journal of Transport History*, II (February, 1974), p. 174.

15. John I. Griffin, *The Port of New York* (N.Y., 1959), pp. 125-126; Barsness, "Maritime Activity," p. 176. For background, see Robert R. Albion, *The Rise of New York Port, 1815-1860* (N.Y., 1930).

16. W. R. Corwine to President William McKinley, April 14, 1900 in General Correspondence, No. 34943, Records of the Corps of Engineers (RG 77).

17. Report of Lieutenant Colonel William Ludlow, April 5, 1898 and accompanying documents in U.S. Congress, House, *East Channel, New York Harbor*, 55th Con., 3d Sess., 1899, House Document No. 159, Serial 3807. See also, Chief of Engineers, *Annual Report, 1901*, pp. 1284-1287.

18. H. N. Babcock to New York District Engineer, April 8, 1914 with concurrence of Division Engineer, April 10, 1914, both in General Correspondence, No. 16388/255, Records of the Corps of Engineers (RG 77); U.S. Chief of Engineers, *Annual Report, 1920*, p. 273. See also, Arthur Hewitt, "A Canal at Sea," *Outlook*, XCI (April 24, 1909), p. 962.

19. U.S. Congress, House, *New York Harbor: Channel to Navy Yard*, 63rd Cong., 1st Sess., 1913, House Document No. 44, Serial 6545, P. 19; *ibid., New York Harbor: North on Hudson River*, 62nd Cong., 2d Sess., 1912, House Document No. 719; *ibid., Hudson River, New York*, 61st Cong., 2d Sess., 1910; House Document No. 719, Serial 5732, pp. 5-6; *ibid., New York and New Jersey Channels*, 66th Cong., 2d Sess., 1920, House Document No. 653, Serial 7698.

20. U.S. Congress, House, *Delaware River, from Allegheny Avenue, Philadelphia to the Sea*, 61st Cong., 2d Sess., 1910, House Document No. 733.

21. U.S. Chief of Engineers, *Annual Report, 1918*, pp. 4042-4047; Holt, *Office of the Chief of Engineers*, pp. 24-25.

22. Holt, *Office of the Chief of Engineers*, pp. 51-52, 84-85.

23. *Ibid.*, pp. 52-55, 187-188.

24. Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* (Cambridge, Mass., 1959). See also Joseph E. Randell, "Legislative Program Congress Should Adopt for Improvement of American Waterways," *Annals of the American Academy*, XXX (January, 1908), pp. 38-39; Herbert Quick, "The Great Cross of the Waterways," *Cosmopolitan*, XLVI (December, 1908), p. 39; Lewis M. Haupt, "The Urgent Need of Waterway Legislation," *North American Review*, CLXXXI (September, 1905), pp. 419-420; "Conservation and the Development of Waterways," *Outlook*, XC (Dec. 19, 1908), p. 843; Forrest Crissey, *Theodore E. Burton, American Statesman* (Cleveland, 1956), pp. 87-104, 180-192.

25. Unsigned (Colonel H. L. Abbot), "Memorandum in regard to prelude and bill prepared by committee of Inland Waterways Commission," in response to Circular from Chief of Engineers to Officers of the Corps, March 29, 1907. See also Major C. A. Flagler, District Engineer, Wilmington, Delaware, to Brigadier General A. MacKenzie, April 8, 1907, both in file No. 62743 in Records of the Corps of Engineers (RG 77).

26. *Engineering News* (April 17, 1902), pp. 47, 310; Holt, *Office of the Chief of Engineers*, pp. 23-24; Hays, *Conservation*, pp. 93-94.

27. Colonel W. M. Black to Chief of Engineers, June 23, 1913 and Colonel W. T. Rossell to Chief of Engineers, June 12, 1913, both in File No. 89933, Records of the Corps of Engineers (RG 77); Colonel Hiram M. Chittenden, "Forests and Reservoirs in their Relation to Stream Flow with Particular Reference to Navigable Rivers," *Proceedings of the American Society of Civil Engineers* (September, 1908), pp. 34, 924-997; the dissent of Brigadier General Alexander MacKenzie to the Preliminary Report of the Inland Waterways Commission, pp. 30-31, 60th Cong., 1st Sess., *Senate Document No. 325* (1907); *Proceedings of the American Society of Civil Engineers* (March, 1909), pp. 63, 254-318; Hays, *Conservation*, pp. 108-109, 203-205.

28. E. W. Burr, acting Chief of Engineers, to Secretary of

War, June 22, 1910, File No. 49678/28, and Major C. A. R. Flagler to Brigadier General A. MacKenzie, April 8, 1907, File No. 63743, both in Records of the Corps of Engineers (RG 77); Hays, *Conservation*, p. 209.

29. Colonel W. M. Black to Chief of Engineers, November 16, 1911 in File No. 72788/792 Records of the Corps of Engineers (RG 77) Italics added.

30. *25 Statutes at Large*, 425 (1888). The original legislation was 24 *Statutes at Large*, 329 (1886).

31. Albert E. Cowdrey, "Pioneering Environmental Law: The Army Corps of Engineers and the Refuse Act," *Pacific Historical Review*, XLVI (August, 1975), pp. 340-341.

32. *Ibid*, p. 342.

33. "The War Department and New York City Docks," *Scientific American*, LXXXVIII (May 30, 1903), p. 408.

34. U.S. Chief of Engineers, *Annual Report*, 1920, pp. 24-25; U.S. Secretary of War, *Annual Report*, 1920, pp. 64-65. Lieutenant Joseph A. Baer, "Uncle Sam — Canal Digger: The Achievements of the Army Engineer Corps Which is to Undertake the Work of Panama," *Harper's Weekly*, (April 27, 1907), pp. 602-605; G. W. Goethals, "The Building of the Panama Canal," *Scribner's Magazine* (March-June, 1915); General J. P. Jervey, "General George W. Goethals," *The Military Engineer* (March-April, 1928); Joseph B. Bishop and Farnham Bishop, *Goethals: Genius of the Panama Canal* (N.Y., 1930).

35. U.S. Secretary of War, *Annual Report, 1913*, pp. 14-17; Jerome Kerwin, *Federal Water-Power Legislation* (N.Y., 1925), pp. 170-262; Jewett, "History of the Corps to 1915," p. 342; Holt, *Office of the Chief of Engineers*, pp. 36-38.

36. *Report of the Board on Fortifications*. House Executive Document No. 49, 49th Cong., 1st Sess., 1886, Serial 2395, pp. 5-8, 28. Hereinafter referred to as the *Endicott Board Report*. *Report of the National Coast Defense Board*, Senate Document No. 248, 59th Cong., 1st Sess., 1906, Serial 4913, pp. 14, 23, 27-29. Hereinafter referred to as the *Taft Board Report*.

37. U.S. Chief of Engineers, *Annual Report*, 1916, pp. 9-11; Lewis, *Seacoast Fortifications of the United States*, pp. 75-78.

38. U.S. Chief of Engineers, *Annual Report, 1916*, pp. 9-11; Emanual R. Lewis, *Seacoast Fortifications of the United States: An Introductory History* (Washington, D.C., 1970), pp. 75-78.

39. U.S. Chief of Engineers, *Annual Report, 1908*, pp. 11-12.

40. Theodore Roosevelt to the Congress, March 5, 1906, in *Taft Board Report*, p. 4; see also Lewis, *Seacoast Fortifications*, pp. 98-100.

— CHAPTER 3

New Responsibilities: Flood Control and Other Missions, 1920-1940

1. U.S. War Department, Office of the Chief of Engineers, General Orders Oct. 7, 1929; Jan. 27, 1930; July 14, 1933; May 17, 1935; Aug. 22, 1936; Oct. 26, 1936; June 8, 1937; July 15, 1937; Oct. 5, 1940; Dec. 10, 1940; Dec. 16, 1940; June 13; 1941; June 26, 1941; Oct. 31, 1941; Dec. 24, 1941.

2. U.S. Congress, House, *Estimate of Cost of Examinations, Etc., of Streams Where Power Development Appears Feasible*, 69th Cong., 1st Sess., 1926, House Document No. 308, Serial 8579.

3. U.S. Congress, House, *Development of the Rivers of the United States*, 73rd Cong., 2d Sess., House Document No. 395, pp. 65-67, 71, 84, 87, 99.

4. "Floods — Nature in a Freakish Mood," *The Literary Digest*, CXX (July 20, 1935), p. 6; "Floods: Empire State Suffers Its Worst Deluge in 70 Years," *Newsweek*, VI (July 20, 1935), p. 9.

5. "Record Floods from New England to the Potomac," *Engineering News-Record*, CXVI (March 26, 1936), pp. 441-442; Floods," *Newsweek*, VII (March 28, 1936), pp. 7-10; William E. Leuchtenburg, *Flood Control Politics: The Connecticut River Valley Problem, 1927-1950* (Cambridge, Mass., 1953), pp. 46-48.

6. "Restore and Protect:" *Engineering News-Record*, CXVI (March 26, 1936), p. 471; Chief of Engineers, *Annual Report, 1936*, pp. 3-6; *ibid.*, 1938, pp. 7-15; Leuchtenburg, *Flood Control Politics*, pp. 48-49.

7. Interview with Albert Gross, July 18, 1975.

8. Colonel G. R. Luskesh to Commanding General, Second Corps Area, July 17, 1935; Colonel E. D. Peek to Chief of Engineers, Aug. 11, 1936, and Lieutenant Colonel C. H. Cunningham to Chief of Engineers, Nov. 9, 1938 all in Records of the Corps of Engineers, District Files No. 6018, Box 575, Suitland, Md.

9. Biographical information based on material from Cullum's *Biographical Directory*, *Annual Report of the Alumni of the U.S. Military Academy*, and *The New York Times*, April 24, 1950, p. 25.

10. U.S., *Statutes at Large*, 49 Stat., 1570 (1936).

11. U.S. Congress, House, *Connecticut River, Mass., N.H., Vt., and Conn.*, 75th Cong., 2d Sess., 1937, House Document No. 455, pp. 2-7, 12-35.

12. *Ibid.*

13. U.S. Congress, House, *Beach Erosion at Jacob Riis Park, Long Island*, N.Y., 74th Cong., 2d Sess., 1936, House Document No. 397, Serial 10033; *ibid.*, *Beach Erosion at Manasquan Inlet, N.J.*, 75th Cong., 1st Sess., 1936, House Document No. 71, Serial 10128; and *ibid.*, *Study of Artificial Bathing Beach, Orchard Beach, N.Y.*, 75th Cong., 2d Sess., 1937, House Document No. 450, Serial 10180, pp. 2-3, 6, 10, 12-13, 20-25.

14. Patrick J. Hurley, "Public Works and Jobs," *Review of Reviews*, LXXXVI (September, 1932), pp. 28-29.

15. U.S. Chief of Engineers, *Annual Report, 1937*, pp. 29-30; U.S. Congress, Senate, *Passamaquoddy Tidal Power Project*, 77th Cong., 1st Sess., 1941, Senate Document No. 41, Serial 10574, especially, pp. 1-5.

16. U.S. Congress, House, *New York Harbor, N.Y.*, 73rd Cong., 2d Sess., 1933, House Document No. 183, Serial 9832, pp. 3-5.

17. U.S. Congress, House, *New York and New Jersey Channels*, 74th Cong., 1st Sess., 1934, House Document No. 133, Serial 9932, pp. 2-4, 8-28.

18. U.S. Congress, House, *Delaware River Between Philadelphia and the Sea*, 75th Cong., 3rd Sess., 1938, Senate Document No. 159, Serial 10248, pp. 1-2, 6-14.

19. U.S. Chief of Engineers, *Annual Report, 1937*, pp. 59-64.

20. On the New York State Barge Canal, see Nobel E. Whitford, *History of the Barge Canal of New York State*, Supplement to the Annual Report of the State Engineer and Surveyor, 1921 (Albany, N.Y., 1922); U.S. Chief of Engineers, *Annual Report, 1937*, pp. 213-217; U.S. Congress, House, *Hudson River Between Albany and Waterford*, 75th Cong., 3rd Sess., 1938, House Document No. 572, Serial 10267, p. 3.

21. Interview with Louis J. Mauriello, former head of NAD's Marine Division, July 9, 1976.

— CHAPTER 4

Across the Seas: The Whirlwind of World War II, 1940-1945

1. W. H. Powers, Chief Administrative Assistant, NAD, to OCE, Sept. 4, 1942, in Records of the Corps of Engineers, District Files No. 4100, Federal Records Center, Suitland, Md.; and Division Engineer, NAD, to Chief of Engineers, June 29, 1942 in *ibid.*, No. 4276.

2. Interview with Henry A. Brevoort, formerly of NAD's Engineering Division, Sept. 2, 1976.

3. Major George F. Bohn, NAD, to Director of Civilian Training, Office of the Secretary of War, through OCE, April 13, 1942, sub: Training of Civilian Employees, Records of the Corps of Engineers, District Files No. 4200, Suitland, Md.

4. *Ibid.*

5. Biographical material from Cullum, *Biographical Register* Vols., VII, VIII, IX; and from interviews with Albert Gross and Henry A. Brevoort.

6. U.S. War Department, Office of the Chief of Engineers, General Orders: Oct. 5, 1940; Dec. 10, 1940; Dec. 16, 1940; Dec. 28, 1940; June 13, 1941; April 22, 1941; June 26, 1941; Oct. 31, 1941; Dec. 24, 1941; May 1, 1942; Dec. 19, 1942; Jan. 9, 1943; March 20, 1943; April 17, 1943; March 14, 1944; Nov. 27, 1944. Colonel Joseph S. Gorlinski to Division Engineer, NAD, sub: Assignment of Code Designators for Overseas Shipments, June 13, 1942 in NAD Engineer Office Files, Room 1210A, 90 Church Street, N.Y.; T. H. Vail Motter, *The Persian Corridor and Aid to Russia* in Office of the Chief of Military History, *The U.S. Army in World War II: Middle East Theater* (Washington, D.C., 1952), pp. 1-7, 40-41, 52, 97, 112, 120-123, 246-253.

7. Lewis, *Seacoast Fortifications*, pp. 100-125; Stetson Conn, *et al.*, *Guarding the United States and Its Outposts*, in Office of the Chief of Military History, *The U.S. Army in World War II: The Western Hemisphere* (Washington, D.C., 1964), pp. 45-54, 94-95. Memo, Logistics Group of Acting Chief of Staff, OPD, 24 October 1945, sub: Modernization Program for Seacoast Defense, OPD 660.2 in Records of the Chief of Staff, National Archives.

8. Division Engineer, NAD, to Office of the Chief of Engineers, October 26, 1942, in Records of the Corps of Engineers, District Files No. 4276, Suitland, Md. For the figures on the Corps' War Construction program in the continental U.S. see Lenore Fine and Jesse A. Remington, *The Corps of Engineers: Construction in the United States*, in Office of the Chief of Military History, *U.S. Army in World War II: The Technical Services* (Washington, D.C., 1972), pp. 520-606.

9. Fine and Remington, *The Corps of Engineers Construction*, pp. 254-255, 267, 440-441, 463-464, 471-472.

10. Major General Eugene Reybold, "Mobilizing Construction for Victory," *The Constructor* (March 1942), p. 53.

11. Division Engineer, NAD, to District Engineer, Providence, R.I., Dec. 4, 1940, in Records of the Corps of Engineers No. 686 (Airfields), Part I.

12. Major General Eugene Reybold, "Unity of Command in Army Wartime Construction," *The Constructor* (July, 1942), pp. 78-79.

13. Conn, *et al.*, *Guarding the U.S.*, pp. 442-455.

14. U.S. Army Corps of Engineers, North Atlantic Division, "Historical Monograph: Greenland," typescript prepared 1946, Section II, pp. 2-6; bound volume located at NAD Office, N.Y., N.Y.

15. *Ibid.*, Section IV, pp. 2, 6 and Section V, pp. 38-52.

16. *Ibid.*, Section X, pp. 1-3.

17. Major H. J. Woodbury, NAD, to OCE, Aug. 5, 1941, reprinted in North Atlantic Division, "Historical Monograph: Greenland," Section IV, pp. 19-20.

18. *Ibid.*

19. *Ibid.*

20. North Atlantic Division, "Historical Monograph: Greenland," Section IV, pp. 21-23; Lieutenant R. J. Haffner to OCE, July 13, 1942, Records of Corps of Engineers, District Files No. 4201.

21. North Atlantic Division, "Historical Monograph: U.S. Army Bases: Newfoundland," (typescript, prepared, 1946), Section X, p. 4 and *passim;* NAD, "Historical Monographs" on Mingan, Goose Bay, Fort Chimo, and Frobisher Bay, Typescripts prepared 1945 and 1946, copies available in bound volumes at NAD, 90 Church Street, New York. U.S. Army Corps of Engineers, Hudson Engineer District, "Completion Report," typescript prepared April 1944, located at NAD, 90 Church St., N.Y., N.Y.

22. Conn, *et al.*, *Guarding the U.S.*, pp. 96-99; U.S. Engineer Office, St. George's Bermuda," typescript, prepared December, 1945, Section III, pp. 1-2, IV, pp. 1-6, X, p. 4; and *ibid.*, "Historical Monograph: Batista Field," typescript prepared, 1945, located in NAD Offices, N.Y., N.Y.

23. Brigadier General Thomas M. Robins to Division Engineers, NAD, Oct. 28, 1941, sub: Iranian Mission, in Records of Corps of Engineers, File No. 381 (Middle East) O & T Section Files, Folio 1, Series 1-175; Colonel Joseph S. Gorlinski, Office of the Chief of Engineers, to Division Engineer, NAD, June 13, 1942, NAD Engineer Office Files, Room 1210A, NAD Office, N.Y., N.Y.; Colonel Beverly C. Dunn, NAD, to Office of Chief Engineers, July 8, 1942, Records of Corps of Engineers, District File No. 4276, Suitland, Md., Vail Motter, *Persian Corridor*, pp. 40-48, 107-113, 123-248.

24. Fine and Remington, *Corps of Engineers: Construction*, pp. 448-449.

25. Division Engineer, NAD, to Chief of Engineers, Oct. 26, 1942, Records of the Corps of Engineers, District File No. 4276, Suitland, Md. Interview with Phillip Handelman, NAD, Aug. 20, 1976.

26. Interview with Ernest Fortino, Chief of the Marine Design Division in Philadelphia, Sept. 17, 1976. See also Clarence E. Boesch, Head of Engineering Branch, NAD, to Chief of Engineers, Oct. 1, 1942, sub: Monthly Report on Status of All Dredges Working within Limits of North Atlantic Division, in Records of Chief of Engineers, District Files No. 3635, Suitland, Md.

27. Fine and Remington, *The Corps of Engineers: Construction*, pp. 650-701; General Leslie R. Groves, *Now It Can Be Told: The Story of the Manhattan Project* (N.Y., 1962).

28. Interview with Albert Gross, Aug. 20, 1976.

29. Colonel James C. Marshall, Diary, located at Historical Division, Office of the Chief of Engineers, Baltimore, Md. Entries of June 17-30, 1942. Fine and Remington, *The Corps of Engineers: Construction*, pp. 651-659.

30. Interview with Henry A. Brevoort, Sept. 2, 1976; Fine and Remington, *Corps of Engineers: Construction*, pp. 677.

31. Interview with Albert Gross, Aug. 20, 1976; Fine and Remington, *Corps of Engineers: Construction*, pp. 569, 573-581.

32. Administrative Division, Office of the Chief of Engineers, to Division Engineer, North Atlantic Division, April 27, 1943, Records of the Corps of Engineers, File No.

210.3, Part I; Fine and Remington, *Corps of Engineers: Construction*, pp. 581-583; Chief of Engineers, General Orders, Dec. 21, 1944; interview with Albert Gross, Aug. 20, 1976.

33. Fine and Remington, *Corps of Engineers: Construction*, pp. 582-585.

34. Interview with George Weinstein, Chief of Real Estate Division, NAD, July 10, 1975.

35. Major General Thomas M. Robins to Division Engineers, Jan. 24, 1942, Records of the Corps of Engineers, File No. 601.1, Suitland, Md.; Colonel John J. O'Brien, speech to Division Engineers, June 16, 1942, Files of Lieutenant Colonel David B. Gideon for history of the military real estate program, 1939-1945, Engineer Historical Division, Baltimore, Md., Major General Thomas M. Robins to Division Engineers, June 19, 1942 and Aug. 14, 1942 both in Records of Corps of Engineers, File No. 601.1, Part I., Suitland, Md., Fine and Remington, *Corps of Engineers: Construction*, pp. 490, 493-495, 510-511.

36. Interview with George Weinstein, July 10, 1975.

37. Division Engineer, North Atlantic Division, to Chief of Engineers, June 29, 1942, Records of the Corps of Engineers, File No. 4276, Suitland, Md.; interview with Philip Handelsman, wartime head of contract section in Operations Branch, NAD, Aug. 20, 1976; Lt. Gen. Eugene Reybold to Division Engineers, Oct. 27, 1942, Engineer Historical Division Files, Baltimore, Md.; Fine and Remington, *Corps of Engineers: Construction*, pp. 495-498.

38. Blanche D. Coll, *et al.*, *The Corps of Engineers: Troops and Equipment* in Office of the Chief of Military History, *U.S. Army in World War II: The Technical Services* (Washington, D.C., 1958), p. 176-179, 510.

39. Chief of Engineers to Division Engineers, Oct. 27, 1942, sub: Reorganization of Engineer Divisions, Records of the Corps of Engineers, Executive Office Procurement Division File, Procurement District. Coll, The Corps of Engineers: Troops and Equipment, pp. 509-510, 521; U.S. Chief of Engineers, General Orders, April 10, 1943.

40. U.S. Chief of Engineers, General Orders, April 10, 1943 and Oct. 30, 1943; Circular Letter No. 2578, Oct. 13, 1943; Acting Chief of Supply Division, Memorandum for Director Materials, ASF, Nov. 10, 1943; Acting Chief of Supply Division, Memorandum for Director Materials, ASF, Nov. 10, 1943, Records of Corps of Engineers, File No. 400.12, Part 114, Suitland, Md.; U.S. Chief of Engineers, *Annual Reports, 1943;* Richard H. Crawford and Lindsley F. Cook, "Procurement," a chapter in Statistics, a volume in preparation for the series, Office of the Chief of Military History, *U.S. Army in World War II*, p. 16; Interview with Albert Gross, Aug. 20, 1976; Operations Branch to Division Engineer, NAD, Aug. 20, 1942, District File No. 6282 and Philip Handelsman to Chief of Engineers, Contracts and Claims Branch, Aug. 19, 1942, District File No. 3635, both in Records of Corps of Engineers, Suitland, Md.; Coll, *Corps of Engineers: Troops and Equipment*, pp. 521-522.

41. U.S. Chief of Engineers, General Orders, Nov. 27, 1943; Nov. 27, 1944; Dec. 7, 1944; U.S. Chief of Engineers, Circular Letter No. 2248, July 2, 1943; sub: Activation of Field Liaison Office, North Atlantic Division; Acting Chief of Engineers to Division Engineer, NAD, April 14, 1943, sub: Establishment of Engineer Port Liaison Office, both in Records of Corps of Engineers, File No. 320.2; Suitland, Md., Coll, *Corps of Engineers: Troops and Equipment*, pp. 530-539.

42. U.S. Chief of Engineers, General Orders, March 23, 1945; Coll, *Corps of Engineers: Troops and Equipment*, pp. 603-607.

43. Interview with Paul Jaenichen, Aug. 20, 1976; U.S. Chief of Engineers, General Orders, Dec. 24, 1941; Jan. 9, 1943.

44. U.S. Congress, House, *Delaware River Anchorage*, 77th Cong., 2st Sess., 1941, House Report No. 340; U.S. Congress, Senate, *Newark Bay*, 79th Cong., 2nd Sess., 1942, Senate Report NO. 250; U.S. Congress, House, *Baltimore Harbor and Channels*, 79th Cng., 2nd Sess., 1942, House Report, No. 741.

45. U.S. Congress, Senate, *New York Bay, Delaware River Section, Intracoastal Waterways*, 79th Cong., 2nd Sess., 1942, Senate Report No. 139.

46. Lt. Gen. Eugene Reybold, *Engineers in World War II: A Tribute (Ft. Belvoir, Va. 1945), pp. 1-2, 10. Fine and Remington, Corps of Engineers: Construction*, pp. 701.

— CHAPTER 5

Defending American Security in the Cold War Era, 1945-1975

1. North Atlantic Division, Program Review and Analysis, 4th Quarter, FYs 1960, 1966, and 1972; Comptroller's Office, NAD.

2. Office of the Chief of Engineers, General Orders, June 2, 1946; Sept. 5, 1946, Sept. 30, 1946.

3. *Ibid.*, Aug. 1, 1947, June 13, 1949.

4. *Ibid.*, May 10, 1950; Nov. 29, 1950; Dec. 18, 1950; Dec. 29, 1950; Jan. 9, 1951; March 16, 1951; March 31, 1951; Sept. 10, 1951; Sept. 17, 1951; Nov. 9, 1951; Feb. 14, 1952; April 8, 1952; May 26, 1952; Sept. 25, 1953; Sept. 1, 1954; Jan. 10, 1955; Nov. 5, 1957; April 16, 1958; Sept. 29, 1958; and May 31, 1963.

5. This account of the construction of Thule AFB is based upon the following sources: "Securing the Northern Bastions: Greenland," typescript prepared by Engineer Historical Division, OCE; letter of Brig. Gen. Clarence Renshaw, USA-Ret. to Jesse A. Remington, Aug. 20, 1976 and accompanying documents; interview with Oswald I. Hewitt, NAD, Nov. 29, 1976; Lt. Gen. Lewis A. Pick, "The Story of Blue Jay," *The Military Engineer* (July-August, 1953), pp. 278ff.

6. Col. Frederick Frech, Division Engineer, NAD, to Brig. Gen. John R. Hardin, Sept. 17, 1951, No. 600.1, Blue Jay; "Securing the Northern Bastions: Greenland," p. 34.

7. The story of Camp Century is told in "Construction of the Army Nuclear Power Plant, PM-2A, at Camp Century, Greenland," Final Report, 1 Aug. 1961, PAO Office, NAD; Typescript of an address by Brig. Gen. Clarence Renshaw to Greater St. Louis Post S.A.M.E., Granite City, Ill., May 17, 1960; Rear Admiral George J. Dufek, "Nuclear Power for the Polar Regions," *National Geographic Magazine*, 212 (June 1962), pp. 712-731; and Walter Wager, *Camp Century; City Under the Ice* (Phila. and N.Y., 1962).

8. Interview with P. R. (Pat) Fiscina, Chief, Military Construction Branch, NAD, Nov. 29, 1976.

9. Interview with Oswald I. Hewitt, Nov. 29, 1976.

10. P. A. Romano, Chief Construction Division of the District, to Division Engineer, NAD, July 30, 1964, located in Historical Records, Military Construction Division, NAD Library, Box 1.

11. Maj. Gen. Thomas Lipscomb to the author, Aug. 25, 1975.

12. "Division Engineer's Inspection" Eastern Ocean District, Sept. 12-24, 1956, prepared by Col. Frederick R.

Hendman, Asst. Division Engineer, NAD, in EOD/FRC, Box 400.

13. Brig. Gen. David S. Parker, NAD, to Col. Richard T. Baston, District Engineer, N.Y., Sept. 7, 1965. See also Paul Jaenichen, NAD, to District Engineer, N.Y., Dec. 15, 1966, both in Historical Records, Military Construction Division, NAD Library, Box 1.

14. Lt. Gen. W. K. Wilson, Jr. to Col. Edward R. Podufaly, Eastern Ocean District Engineer, June 19, 1963, copy in possession of P. R. Fiscina, Military Construction Branch, NAD.

15. Interview with Alfred W. Lellis, Nov. 29, 1976.

16. Chief of Engineers to Division Engineer, NAD, July 5, 1956 and Aug. 27, 1956, both in NAD/FRC, Box 44.

17. Lellis Interview.

18. Colonel B. B. Talley to Chief of Engineers, Jan. 29 and Feb. 9, 1953, Papers of Lieutenant General S. D. Sturgis, Jr. located at Engineer Historical Division, Baltimore, Md.; hereinafter referred to as the Sturgis MSS; Weinstein interview; Colonel W. A. Carter to Office of the Chief of Engineers, June 20, 1952; L. P. Walker, Chief, Real Estate Division, NAD, to District Engineers of Washington and New York Districts, May 22, 1952; and clipping from *The New York Times*, March 14, 1952 all in NAD/FRC, Box 51.

19. On the Capehart Housing see Administrative Rules and Regulations for Armed Services Mortgage Insurance under Title VIII of the National Housing Act of 1949 revised January 13, 1956 (FHA, 1956); Colonel Clarence Renshaw, NAD, to Brig. General David H. Tulley, Office of the Chief of Engineers, Jan. 25, 1956; Telegram, Division Engineer, NAD, to Chief of Engineers, June 9, 1956; Paul A. Jaenichen, NAD, to Chief of Engineers, June 15, 1956, all in NAD/FRC, Box 44; Lellis Interview.

20. Interviews with Wesley Price, Former Executive Assistant, NAD, July 13, 1975 and Alfred Lellis, Nov. 29, 1976.

21. Colonel C. R. Bronn to Chief, Construction-Operations Division, NAD, Oct. 5, 1965, Box 1; and J. G. Pack to Division Engineer, sub: West Point Expansion Program, Jan. 13, 1966, Box 2; both in Historical Files, Military Construction Division, NAD Library.

22. Major General David S. Parker to the author, Oct. 28, 1975.

23. U.S. Congress, Senate, 91st Cong., 2d Sess., Subcommittee on Military Construction of the Committee on Armed Services 1970, *Military Authorization, FY 1971: Joint Hearings* (Washington, D.C., 1970), p. 162; Major General R. H. Groves to the author, Sept. 3, 1975.

24. Major General C. M. Duke to Chief of Engineers, Feb. 13, 1970, Executive Files, NAD; Brigadier General James L. Kelly to Chief of Engineers, May 20, 1975, and Feb. 18, 1975 both in *ibid.*

25. On the projects in NAD relating to the U.S. effort in Southeast Asia see OCE to NAD, Aug. 1965; A. J. Richards, Chief, Military Construction Branch, Memo for the Record, sub: Status of Projects in Support of Southeast Asia Effort, Nov. 1, 1965 *ibid.*, Memo, sub: Army Training MOS Program, May 19, 1966; *ibid.*, sub: Proposed OCS and Branch School Program in support of Southeast Asia, April 11, 1966; John G. Pack, Chief, Construction-Operations Division, NAD, to District Engineer, Norfolk, sub: Negotiation Authority — Viet Nam Buildup, April 7, 1966, all in Historical Records, Military Construction Division, NAD Library, Boxes 1 and 2.

26. Interview with Oswald I. Hewitt, NAD Comptroller, Dec. 17, 1976; Interview with Albert Gross, former NAD Chief Counsel, Dec. 17, 1976; Table of Organization Chart, 15 Oct. 1952, located in Finding Guide, NAD Records, Federal Records Center, Bayonne, N.J. (thereinafter referred to as NAD/FRC).

27. *Who's Who in Engineering, 1964;* Press Release, Office of the Chief of Engineers, April 30, 1959, copy in Historical Files, NAD.

28. Office of the Chief of Engineers, General Regulations, 1956, No. 1004.02.

29. Major General S. D. Sturgis, Jr. to Colonel B. B. Talley, June 10, 1954, Sturgis MSS.

30. Sturgis to Talley, April 1, 1954, Sturgis MSS; Colonel Clarence Renshaw to Governor Averell Harriman and other governors, March 6-22, 1956, NAD/FRC, Box 45.

31. Major General R. H. Groves to Chief of Engineers, Aug. 10, 1973; Nov. 8, 1973, Executive Files, NAD; "Notes of District Engineers Conferences, March 19-20, 1956 and July 19-20, 1956," Mimeographed, NAD/FRC, Box 43.

32. Major General S. D. Sturgis, Jr. to Colonel B. B. Talley, April 1, 1954; Talley to Sturgis, Sept. 8, 1954, and Oct. 4, 1954, all in Sturgis MSS.

33. Major General R. H. Groves to Chief of Engineers, Feb. 15, 1974 and May 16, 1972 both in Executive Files, NAD.

34. Brigadier General James L. Kelly to Chief of Engineers, Feb. 18, 1975, in *ibid.*

35. Major General R. H. Groves to Chief of Engineers, May 15, 1974, in *ibid.*

36. Lieutenant General W. C. Gribble, Jr. to Major General R. H. Groves, June 18, 1974, in *ibid.*

37. Lieutenant General W. C. Gribble, Jr. to Major General James F. Kelly, Sept. 12, 1975, in *ibid.*

38. Colonel Clarence Renshaw to Governor Averell Harriman and other governors, March 6-22, 1956, NAD/FRC, Box 45.

— CHAPTER 6

Expanding Traditional Civil Works Activities, 1945-1975

1. Lieutenant General S. D. Sturgis, Jr. to Colonel Clarence Renshaw, Sept. 3, 1955, Dec. 1955, both in Sturgis MSS. See also District Engineers Conference, July 19-20, 1956, NAD/FRC, Box 43 and Colonel Renshaw to Governors of Pennsylvania and New York, March 16, 1956, NAD/FRC, Box 45.

2. Major General Thomas H. Lipscomb to author, Aug. 25, 1975.

3. Major General John C. Dalrymple to author, Aug. 25, 1976.

4. This account of Tropical Storm AGNES is based upon the following sources: Paul Kent Walker, "The Corps Responds: A History of the Susquehanna Engineer District and Tropical Storm Agnes," typescript. November 1974, copy located in the Public Affairs Office, NAD; Major General Richard H. Groves, "The Agnes Disaster," *The Military Engineer*, LXIV (November-December, 1972), pp. 381-387, and LXV (January-February, 1973), pp. 16-21; U.S. Army Corps of Engineers, Susquehanna District, North Atlantic Division After Action Report: Tropical Storm Agnes, and Supplement (Harrisburg, 1972); U.S. Army Corps of Engineers, North Atlantic Division, "The Great Flood of 1972;" U.S. Senate, Subcommittee on Disaster Relief of the Committee on Public Works, *Hearings to Investigate the Adequacy and Effectiveness of Federal Disaster Relief Legislation*, 93rd Cong., 1st Sess. (Washington, D.C., 1973).

5. Interview with Major General Richard H. Groves, July 17, 1974 quoted in Walker, "The Corps Responds," p. 81.
6. Interview with Colonel John F. McElhenny, July 19, 1974, quoted in *ibid.*, p. 96.
7. Lieutenant General W. C. Gribble, Chief of Engineers, to Brigadier General Richard H. Groves, June 18, 1974, Executive Files, NAD.
8. Major General Richard H. Groves to author, Sept. 3, 1975.
9. Biographical information on Major General Richard Groves from press releases available in Public Affairs Office, NAD.
10. Interview Alvin P. Vinitsky, Chief, Construction-Operations Division, NAD, July 15, 1975; U.S. Army Corps of Engineers, NAD, *Water Resources Development in Pennsylvania, 1975*, pp. 53-54.
11. Notes, District Engineers Conference, March 19-20, 1956 and Conference of Division Engineers, Sept. 6, 1956, both in NAD/FRC, Box 43.
12. Major General R. H. Groves to Chief of Engineers, Feb. 15, 1974, Executive Files, NAD.
13. Major General R. H. Groves to Chief of Engineers, Aug. 10, 1973, Executive Files, NAD.
14. Major General Richard Groves quoted in Frank E. Snyder and Brian H. Guss, *The District: A History of the Philadelphia District, U.S. Army Corps of Engineers, 1866-1971* (Philadelphia, 1974), p. 219.
15. Major General James L. Kelly to Chief of Engineers, sub: Tocks Island Lake Project, Comprehensive Analysis of Project and Alternatives, undated (July, 1975), copy in Public Affairs Office, NAD.
16. Major General James L. Kelly to Chief of Engineers, Aug. 15, 1975, Executive Files, NAD, Lieutenant General William C. Gribble, Jr. to Kelly, Sept. 12, 1975, *ibid.*
17. John I. Griffin, *The Port of New York* (N.Y., 1959); p. 46; American Public Works Association, *History of Public Works in the United States, 1776-1975* (Chicago, 1976), p. 48.
18. Notes, District Engineers Conference, March 19-20, 1956, NAD/FRC, Box 43.
19. Colonel B. B. Talley to Chief of Engineers, April 6, 1954, Sturgis MSS.
20. Major General Thomas H. Lipscomb to author, Aug. 25, 1975.
21. Major General John C. Dalrymple to author, Aug. 25, 1976.
22. Major General Richard H. Groves to Chief of Engineers, May 15, 1974, Executive File, NAD.
23. Lipscomb to author, Aug. 25, 1975.
24. Interview with Alvin P. Vinitsky, July 15, 1975.
25. Major General James L. Kelly to Chief of Engineers, Feb. 18, 1975, Executive Files, NAD.
26. Major General Richard H. Groves to Chief of Engineers, Aug. 16, 1974, *ibid.*
27. Lieutenant General F. J. Clarke, Chief of Engineers, to Major General Richard H. Groves, June 25, 1973, *ibid.*
28. Interview with Louis J. Mauriello, retired Chief of Marine Division, NAD, July 9, 1976; interview with Ernest Fortino, Chief of the Marine Design Division, Philadelphia District, Sept. 17, 1976; U.S. Army Corps of Engineers, General Orders, February 5, 1944; Dec. 1, 1947; May 18, 1951; Nov. 16, 1959.
29. U.S. Army Corps of Engineers, North Atlantic Division, Program Review and Analysis, FYS 1960, 1966, 1972.
30. U.S. Army Corps of Engineers, General Orders, Aug. 31, 1973.
31. Major General James L. Kelly to Chief of Engineers, Nov. 13, 1974, Executive Files, NAD.
32. *Ibid.*, Feb. 18, 1975.

— CHAPTER 7

Meeting New Challenges, 1960-1975

1. Albert E. Cowdrey, "Pioneering Environmental Law: The Army Corps of Engineers and the Refuse Act," *Pacific Historical Review*, XLVI (August, 1975), pp. 331-349.
2. Major General Charles M. Duke to Chief of Engineers, Feb. 13, 1970; Lieutenant General F. J. Clarke to Duke, Feb. 27, 1970, both in Executive Files, NAD.
3. Duke to Chief of Engineers, April 12, 1970, in *ibid.*
4. Office of the Chief of Engineers, *1972 Water Quality Act* (Washington, D.C., 1973), PAO/NAD; Interviews with Alvin P. Vinitsky, Chief, Construction-Operations Division, NAD, July 15, 1975; Nov. 29, 1976; and Feb. 23, 1977.
5. Major General R. H. Groves to Chief of Engineers, May 15, 1974, in Executive Files, NAD.
6. Lieutenant General W. C. Gribble, Jr. to Groves, June 18, 1974, in *ibid.*
7. *The New York Times*, May 17, 1975; Office of the Chief of Engineers, *Questions and Answers Related to the Corps of Engineers New Regulations Covering Section 404, PL 92-500* (October, 1975), copy in PAO/NAD.
8. Lieutenant General W. C. Gribble, Jr. to Major General R. H. Groves, June 18, 1974, Executive Files, NAD.
9. Office of the Chief of Engineers, Applications for Department of the Army Permits for Activities in Waterways (Oct. 1, 1974); *ibid.*, Civil Works in Review (1974); interview with Herbert Howard, head of Planning Division, NAD, July 10, 1975.
10. NAD, Hurricane Agnes: Environmental and Ecological Impact: Summary Statement, undated (1974), PAO/NAD; Howard interview.
11. Major General James L. Kelly to Chief of Engineers, May 28, 1976 and Sept. 10, 1976 both in Executive Files, NAD; Vinitsky interview, Feb. 22, 1977.
12. John F. Wall, "The Civil Works of the U.S. Army Corps of Engineers: Program Modernization," doctoral dissertation, Cornell University, 1973, p. 172; Howard interview, July 10, 1975.
13. Howard interview, July 10, 1975.
14. Paul H. Jaenichen, Chief of Engineering Division, NAD, to Office of Chief of Engineers, June 22, 1956, NAD/FRC, Box 42.
15. Colonel B. B. Talley to Major General S. D. Sturgis, Jr., March 3, 1953; May 11, 1953; and March 14, 1955, all in Sturgis MSS.
16. Major General David S. Parker to the Author, Oct. 28, 1975.
17. Biographical Sketch of Major General Francis P. Koisch, February, 1977, PAO/NAD.
18. Burham H. Dodge, Chief, Planning Division, NAD, Remarks to the New England River Basins Commission, Boston, Mass., Nov. 17, 1967, copy in PAO/NAD, pp. 5-6.
19. This account of the NAR study is based upon the following: NAR, *Water Resources Study Coordinating Committee, Report* (1972); Presentation to NAR Conference, by Brigadier General David S. Parker, Jan. 27, 1966; NAR Study a Fact Sheet; all in PAO/NAD; Harry E. Schwarz and David C. Major, "The Systems Approach: An

Experience in Planning," *Water Spectrum* (Fall, 1971), pp. 1-6; Brigadier General William Whippel, Jr., "Water Supply and Energy Production in the Northeast," *The Military Engineer* (May-June, 1975), pp. 139-142.

20. Major General R. H. Groves, NEWS, Keynote Address before the 11th Annual Delaware River Basin Water Resources Conference, Spring Glen, N.Y., Oct. 15, 1974, copy in PAO/NAD, pp. 5-6.

21. Howard interview, Feb. 22, 1977.

22. U.S. Congress, 93rd Cong., 1st Sess., *National Shoreline Study*, House Document No. 93-121 (5 vols., Washington, D.C., 1973); OCE; *The National Shoreline Study* (August, 1973); Interviews with Herbert Howard, NAD, Feb. 22, 1977 and Francis J. Coppinger, NAD Engineering Division, Feb. 22, 1977.

23. North Atlantic Division, Report on Atlantic Coast Deepwater Port Facilities Study (July, 1973), PAO/NAD; testimony of Major General R. H. Groves, NAD, before the U.S. Congress, House Committee on Appropriations, Subcommittee on Public Works, *Hearings: Public Works for Water and Power Development and Atomic Energy Commission Appropriation Bill*, 1975, 93rd Cong., 2d Sess., 1974, pp. 385-386.

24. Groves testimony in *ibid.*, p. 387; North Atlantic Division, Public Affairs Office, Urban Studies Information Kit, including FY 1974 and FY 1975 Programs; PAO/NAD.

25. North Atlantic Division, "Civil Defense Support Program in NAD," typescript, Feb. 18, 1975, Historical Files, NAD.

26. Dennis S. Lavery, "The Postal Support Effort of the Corps of Engineers," typescript dated Feb. 17, 1976, copy in the Engineers Historical Division, Baltimore, Md.

27. Brigadier General George A. Rebh, "Postal Construction and the Price of Postage Stamps," *The Military Engineer* (July-August, 1972), pp. 263ff.

28. Major General C. M. Duke, NAD, to Chief of Engineers, Nov. 20, 1970, Historical Files, NAD.

29. Memorandum of Understanding between the U.S. Post Office Department and the U.S. Army Corps of Engineers, Nov. 16, 1970, copy in Historical Files, NAD.

30. Lavery, "Postal Support Effort," p. 21.

31. Brigadier General George A. Rebh to Division Engineer, NAD, sub: Major Postal Construction Program, NAD, FY 1971 and FY 1972; and Brigadier General R. H. Groves to General Rebh, Oct. 29, 1971, both in Historical Files, NAD.

32. Major General D. A. Raymond to Brigadier General James L. Kelly, June 20, 1975 and Kelly to Chief of Engineers, May 20, 1975, both in Executive Files, NAD; Lavery, "Postal Support Effort," pp. 91, 98.

33. Interview with Thomas C. Thompson, coordinator of the Military Construction, Army Reserves Program, NAD, Feb. 22, 1977.

SELECTED BIBLIOGRAPHY

I

Manuscript Sources

Sturgis, Lieutenant General S.D., Jr. Papers. Engineer Historical Division, Baltimore, Md.

U.S. Army. Chief of Engineers. General Orders. Office of the Chief of Engineers, Washington, D.C.

—— Corps of Engineers. Eastern Division Records. RG77 The National Archives, Washington, D.C.

—— Corps of Engineers. Eastern Ocean Division Records. RG77 Federal Records Center, Bayonne, N.J.

—— Corps of Engineers. North Atlantic Division Records. RG77 Federal Records Center, Bayonne, N.J. and NAD Headquarters, 90 Church Street, N.Y., N.Y.

—— Corps of Engineers. Northeast Division Records. RG77 National Archives, Washington, D.C.

—— Corps of Engineers. Office of the Chief of Engineers Records. RG77 The National Archives, Washington, D.C.

—— Corps of Engineers. Records. RG77 Federal Records Center, Suitland, Md.

II

Government Documents

U.S. *American State Papers.* 38 Vols. Washington, D.C., 1832-1861.

U.S. Army. Corps of Engineers. *Genesis of the Corps of Engineers.* Fort Belvoir, Va., 1966.

—— *History and Traditions of the Corps of Engineers.* Fort Belvoir, Va., 1953.

U.S. Congress, House. *Documents and Reports.* Washington, D.C. 1819—.

U.S. Congress, Senate. *Documents and Reports.* Washington, D.C., 1847—.

III

Books

Albion, Robert G. *The Rise of New York Port, 1815-1860.* N.Y., 1939.

Ambrose, Stephen E. *Duty, Honor, Country: A History of West Point.* Baltimore, 1966.

American Public Works Association. *History of Public Works in the United States, 1776-1976.* Chicago, 1976.

Armytage, W.H.G. *A Social History of Engineering.* Cambridge, Mass., 1961.

Bruchey, Stuart. *The Roots of American Economic Growth, 1607-1861.* N.Y., 1965.

Calhoun, D.H. *The American Civil Engineer.* N.Y, 1960.

Coll, Blanche D., *et al. The Corps of Engineer: Troops and Equipment.* In Office of the Chief of Military History, *U.S. Army in World War II: The Technical Services.* Washington, D.C., 1958.

Coggins, Jack. *Arms and Equipment of the Civil War.* N.Y., 1962.

Conn, Stetson, *et al. Guarding the United States and Its Outposts.* In Office of the Chief of Military History, *The U.S. Army in World War II: The Western Hemisphere.* Washington, D.C. 1964.

Cullum, George W. *Biographical Register of Officers and Graduate of the U.S. Military Academy.* 3rd ed., N.Y. 1891—

de Camp L. Prague. *The Ancient Engineers.* Cambridge, Mass., 1960.

Dod, Karl C. *The Corps of the Engineers: The War Against Japan.* In Office of the Chief of Military History, *U.S. Army in World War II: The Technical Services,* Washington, D.C., 1966.

Dupuy, R. Ernest. *Men of West Point: The First 150 Years of the United States Military Academy.* N.Y., 1951

Fine, Lenore and Remington, Jesse. *The Corps of Engineers: Construction in the United States.* In Office of the Military History, *U.S. Army in World War II: The Technical Services.* Washington, D.C., 1972.

Forbes, R.J. *Man the Maker: A History of Technology and Engineering.* London, 1958.

Ganoe, William A. *The History of the United States Army.* N.Y., 1924.

Gillie, B. *The Renaissance Engineers.* London. 1966.

Goodrich, Carter. *Government Promotion of American Canals and Railroads, 1800-1890.* N.Y., 1960.

Grant, Bruce. *American Forts: Yesterday and Today.* N.Y., 1965.

Griffin, John I. *The Port of New York.* N.Y., 1959.

Hammond, John M. *Quaint and Historic Forts of North America.* Philadelphia, 1915.

Hays, Samuel P. *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920.* Cambridge, Mass., 1959.

Hill, Forest G.R. *Rails and Waterways: The Army Engineers of the Army: Its Non-Military History, Activities, and Organization.* Baltimore, 1923.

Ingersoll, L.D. *History of the War Department.* Washington, D.C., 1879.

Institution of Royal Engineers, *The History of the Corps of Royal Engineers.* Nine vols., London, 1889-1958.

Kite, E.S. *Brigadier-General Louis LeBeque du Portail.* Baltimore, 1933.

Leuchtenburg, William E. *Flood Control Politics: The Connecticut River Valley Problems, 1927-1950.* Cambridge, Mass., 1953.

Lewis, Emanual Raymond. *Seacoast Fortifications of the United States: An Introductory History.* Washington, D.C., 1970.

Melegari, Vezio. *Great Military Sieges.* N.Y., 1972.

Miller, John A. *Master Builders of Sixty Centuries.* Freeport, N.Y., 1972.

Motter, T.H. Vail. *The Persian Corridor and Aid to Russia.* In Office of the Chief of Military History, *The U.S. Army in World War II: Middle East Theater.* Washington, D.C., 1952.

Reybold, Eugene. *Engineers in World War II: A Tribute.* Fort Belvoir, Va., 1945.

Sandes, E.W.C. *The Royal Engineers in Egypt and the Sudan.* London, 1937.

Simon, Lester F. *Dredging Engineering.* N.Y., 1920.

Smith, Frank E., ed. *Conservation in the United States: A Documentary History.* 2 vols., N.Y., 1971.

Snyder, Frank E. and Guss, Brian H. *The District: A History of the Philadelphia District, U.S. Army Corps of Engineers, 1866-1971.* Philadelphia, 1974.

Spaulding, Oliver L. *The United States Army in War and Peace.* N.Y., 1937.

Taylor, George R. *The Transportation Revolution, 1815-1860.* N.Y., 1951.

Unstead, R. J. *Castles.* London, 1970.

Wager, Walter. *Camp Century: City Under the Ice.* Philadelphia, 1962.

Weigley, Russell F. *History of the United States Army,* N.Y., 1967.

IV

Articles

Authur, Robert. "Early Coast Fortification," *The Military Engineer,* LIII (July-August, 1961), pp. 279-280.

Barsness, Richard W. "Maritime Activity and Port Development in the United States since 1900: A Survey," *Journal of Transport History,* II (February, 1974), pp. 174ff.

Buzzaird, Raleigh B. "America's First Chief Engineer," and "Washington's Favorite Engineer," *The Military Engineer, XXXIX* (December, 1947), pp. 505-510 and XL (March, 1948), pp. 115-118.

Cowdrey, Albert E. "Pioneering Environmental Law: The Army Corps of Engineers and the Refuse Act," *Pacific Historical Review,* XLVI (August, 1975), pp. 340ff.

Dufek, George J. "Nuclear Power for the Polar Regions," *The National Geographic Magazine,* CCXII (June, 1962), pp. 712-731.

Ellis, Robert R. "Richard Gridley: First Chief Engineer of the Army," *The Military Engineer,* LV (1963), pp. 157-160, 265-268.

Groves, Richard H. "The Agnes Disaster," *The Military Engineer,* LXIV (November-December, 1972), pp. 381-387 and LXV (January-February, 1973), pp. 16-21.

Heavey, W.F. "The Corps in the Days of the Revolution," *The Military Engineer,* XXXI (November-December, 1939), pp. 410-415.

Jewett, Henry C. "History of the Corps of Engineers to 1915," *The Military Engineer* (September-October and November-December, 1922).

Johnson, Leland R. "19th Century Engineering: The Contract of 1824," *The Military Engineer,* LXV (1973), pp. 166-171, 252-257.

Pick, Lewis A. "The Story of Blue Jay," *The Military Engineer,* (July-August, 1953), pp. 278ff.

Rebh, George A. "Postal Construction and the Price of Postage Stamps," *The Military Engineer,* (July-August, 1972), pp. 263ff.

Rees, Thomas H. and Youngberg, G.A. "History of the Engineer Troops in the United States Army, 1775-1901," *Occasional Papers of the Engineer School, No. 37.* Washington, D.C., 1910.

Reybold, Eugene. "Mobilizing Construction for Victory," *The Constructor* (March, 1942), pp. 53ff.

Thompson, Gilbert. "The Engineer Battalion in the Civil War." *Occasional Papers of the Engineer School, No. 44.* Washington, D.C., 1910.

Wippel, William, Jr. "Water Supply and Energy Production in the Northeast," *The Military Engineer* (May-June, 1975), pp. 139-142.

Winslow, E. E. "Lectures on Seacoast Defense," *Occa-*

sional Papers of the Engineer School, No. 35. Washington, D.C., 1909.

V

Unpublished Works

Kelso, Harold. "Inland Waterways Policy in the United States," Doctoral dissertation, University of Wisconsin, 1942.

Bery, Dennis S. "The Postal Support Effort of the Corps of Engineers." Typescript, February, 1976. Copy in the Engineers Historical Division, Baltimore, Md.

Ross, Edward L. "History of Rivers and Harbors Appropriation Bills, 1866-1933." Doctoral dissertation, Ohio State University, 1938.

U.S. Army Corps of Engineers, North Atlantic Division. "Historical Monographs." Typescripts prepared 1945-1946.

Walker, Paul Kent. "The Corps Responds: A History of the Susquehanna Engineer District and Tropical Storm Agnes." Typescript, November, 1974. Copy in Public Affairs Office, NAD.

VI

Other Sources

U.S. Army Corps of Engineers, North Atlantic Division. Correspondence between the author and the following former NAD Division Engineers: Benjamin B. Talley (1952-1955), Clarence Renshaw (1955-1959), Thomas H. Lipscomb (1959-1962), John C. Dalrymple (1962-1966), Francis P. Koisch (1966-1968), Richard H. Groves (1971-1974). July to October, 1975.

U.S. Army Corps of Engineers, North Atlantic Division. Personal interviews by the author with a number of current and retired employees. 1975-1977.

INDEX

Abbot, Brig. Gen. Frederick V. 27
Abbot, Col. Henry L. 28, 36
  biography 26, 27
Aberdeen, MD 97
Adirondack Mountains 91
AGNES. *see* Hurricane AGNES, Tropical Storm AGNES
Agriculture, Department of 128, 130
Aircraft Warning and Radar Stations 91
air ferries 69, 73
airfields, civilian 74
Air Force
  construction for ix, 86-88
  modernization of bases 74, 91-92
Albany, NY 59, 93
Alcan Highway 61
Ambrose Channel 29, 32
Ambrose, John W. 29
American Expeditionary Force (A.E.F.) 25, 39
American Society of Civil Engineers 16
Anacostia River 33
Aqueduct, Washington xiv, 16, 23
architecture, military 3, 8, 9, 19, 20, 38, 64-65, 93
Arctic Circle 71, 73, 87
armaments 8, 9, 19, 20, 21, 38-39, 64
armories 94
Army Air Corps
  bases 69, 71, 74
  construction for 67
Army, Department of, regional water study 130
Army Engineer School 21, 26, 41
Army Material Command xv
Army Reserves 94, 137
Army Service Commands 79, 80, 82, 83
Army Service Forces Headquarters 82
arsenals 74, 94, 97
Arthur Kill 32, 117
Atlantic Cable 29
Atlantic Coast Deep Water Port Facilities Study xv
atomic bomb 74-75
  see also Manhattan Project
Azores xi, 73, 85, 86, 91
Azores District, Corps of Engineers 85

Bald Eagle Creek 112
Ballistic Missile Early Warning System (BMEWS) 89, 91

Baltimore
  embarkation facilities 39
  fire 36
  harbor improvements 29, 32, 55, 81
  Mid-Atlantic Division 69
  NIKE sites 94
  port of x, 23, 29
Baltimore District, Corps of Engineers xiii, 23, 55, 99, 106, 113, 125, 136, 137
Baltimore and Ohio Railroad 10, 14
batteries, coastal defense 20, 21, 39, 64, 65
Bay of Fundy 52-53
beach(es)
  erosion xv, 43, 51-52, 60, 104, 121-122, 130, 131
  nourishment 122
  reconstruction 52, 104, 121, 122
Bermuda 61, 73, 86, 91
Bermuda District, Corps of Engineers 71, 85
Bingham, Brig. Gen. Theodore A. 41
Binghamton, NY 132
Black, Col. William M. 36, 37
Blacksburg, VA xvi
Bloomington Lake, MD xv
Blount, Winton M. 133
BLUEJAY, Project 87
Blue Marsh Lake xv
BMEWS (Ballistic Missile Early Warning System) 89, 91
Board of Engineers for Fortifications 12, 19, 26
Board of Engineers for Internal Improvements 14
Board of Engineers for Rivers and Harbors 29, 37, 50, 53
Board of Ordnance and Fortification 26
BOMARC missile 93
bomb, atomic fission 74-75
Boston and Providence Railroad 16
Boston District, Corps of Engineers 59, 85
Boston, MA
  defenses 64
  harbor improvement 32
  in Revolutionary War 3
  New England Division 69
  NIKE site 94
Bragdon, Lt. Col. John S. 74
Breed's Hill 3
bridges 16, 33, 118, 119
Brooklyn Navy Yard 32
Buffalo, NY 59, 94
Bulk Mail System 136
Bunker Hill 3
Burma Road 61

Cabin John Bridge 16
Calhoun, John C. 12
Camden, NJ 132
camouflage, design of 74

Camp Century, Greenland 89
Camp Drum, NY 79
Camp Humphreys, VA 41
see also Fort Belvoir
Camp Kilmer, NJ 79
Camp Shanks, NY 79
Canada
air bases in 73, 85, 86, 91
District, Corps of Engineers 85
in World War II 61, 69
canals
construction of 1, 10, 14
government purchase of 33, 36, 55
improvements to 55, 118
in World War II 82
Cape Cod Canal 55, 59
Capehart Housing 94
Capehart, Wherry-, legislation 94
Cape May, NJ
beach erosion 121
Canal 82
Capitol Building 16
Caribbean Sea 37
bases 69, 73
Casey, Brig. Gen. Thomas L. 25
Central Concrete Laboratory 74
CEPCSO (Corps of Engineers Postal Contruction Support Office) 136
Chemung River 106
Chesapeake and Delaware Canal 14, 55, 118, 119
government purchase of 33
in World War II 82
Chesapeake and Ohio Canal 14
Chesapeake Bay 10, 37, 117, 118, 122, 128
defenses 64
effects of AGNES on 125-126
hydraulic model of, 128
Chesapeake Division 26
Chester Creek Basin, PA 132
Chicopee, MA 50
Christina Creek Basin, DE 132
Civil Aeronautics Authority, airfields 74
civil defense 132-133
Civil Defense Support Program 132, 133
Civilian Conservation Corps 52
Civil Preparedness Support Activities 132, 133
Civil War 1, 17, 19, 20
civil works projects xiii, 23, 29, 60, 81, 103-119,
Coastal Plain 46
Codorus Creek Basin, PA 132
Cold War 85-94
"Columbiads" 9, 19
Commerce, Department of 128, 130

Community Shelter Planning Program 132
Connecticut 47, 131, 132
Connecticut River 46-50
conservation of resources 36, 43
Constitution, interstate commerce clause of 36
construction, military
  airfields 74
  during Civil War 20
  during World War II
    overseas 61-73
    domestic 74
  funding xiii, 94
  housing xv, 65, 74
  training facilities 97
contract(s) 75, 99
Corning, NY 106
Corps of Artillerists and Engineers 6
Corps of Engineers Postal Construction
  Support Office (CEPCSO) 136
Council on Environmental Quality 125
Cowanesque Lake, PA xv
Craighill, Col. William P 25, 26
Crystal Palace 2
Cuba 73
Cumberland, MD xv, 14
Cunard Line 29, 32

dams
  flood control 47, 109, 110, 112, 113
  for power generation 36
  see also power generation
D-Day invasion 61
defense, civil 132
defense(s)
  antiaircraft missile 85
  antisubmarine 26, 73
  coastal 20, 21, 37, 39, 64, 65
  modern 65
Defense, Department of 97, 137
Delaware Bay 23, 125
Delaware River
  basin x, 128, 130
  breakwater 14
  dredging 28, 32, 55, 81
  estuary 125
  flooding 46
  ice breaker 10
  Tocks Island Dam 113, 114
Delaware River Basin Commission 114, 130
Delaware River Basin Water Resources Conference 130
Delaware, state of 103, 131
Delaware Water Gap
  National Recreation Area 113
Denmark, agreements with, in World War II 70, 71
  see also Greenland, Thule Air Force Base

depots, storage	74, 80, 85, 94, 97
Depression, Great, public works in	52, 59
DEW. (Distant Early Warning)	85, 89
Diamond, Harry, Laboratories Complex	xv, 97
disasters, natural	103-104, 106, 128
prevention	43, 106-107, 128, 132
relief	33, 36, 103, 106-107
Disaster Relief Act of 1974	107
Distant Early Warning Systems (DEW)	85, 89
District, Engineer	xiii
District of Columbia	xi, 23, 130
defense of	20
maintenance of	33
see also Washington, D.C.	
Division, Engineer	xiii
Dobbs Ferry, NY	4
Dodge, Burnham H.	130
dredges	xv, 33, 55, 59, 74, 81, 104, 117, 120, 121, 122
see also harbor(s), improvements; navigation	
dredging	xiv, xv, 23, 28, 29, 32, 33, 114, 117, 127
beach reconstruction	52, 104
material from	117, 118, 125
Driftmaster	118
drift, removal of	xv, 118
Duke, Maj. Gen. Charles M.	124
dumping	117
see also spoil, dredging	
Dunn, Brig. Gen. Beverly Charles	79
biography	63-64
early warning systems	85, 89, 91, 100
earthquakes	132
East Channel	32
see also Ambrose Channel	
Eastern Division	26, 41, 43
East Ocean Division	86, 89, 91
Eastport, ME District, Corps of Engineers	53
Eaton, Col. Charles	82
Ecole Polytechnique	2
Edgewood Arsenal, MD	74
Egypt	73
Eiffel, Gustave	2
Eiffel tower	2
Elizabeth, NJ	32
Elmira, NY	106
Emergency Broadcast Protection Program	132
Emergency Operating Center Program	133
Emergency Planning, Office of	104, 107
Emergency Relief Appropriation Act	55, 59
Endicott, William C.	37
Endicott-Taft seacoast defense system	37
Engineer District	xiii, 23, 67
Engineer Division	xiii, 25-26, 67, 132

engineering, schools of 1, 2, 6, 7, 21, 27, 41, 63
engineers
  British 2
  French 2, 3
  Polish 3
Engineers, Corps of
  functions ix-xvi
  origin ix, 6
  see also defenses; disasters, natural; erosion; fortifications; flood(s); harbor(s); navigation; procurement
Engineers, Corps of, Districts
  Azores 85
  Baltimore xiii, 23, 55, 99, 106, 113, 125, 136, 137
  Bermuda 71, 85
  Boston 59, 85
  Canada 85
  Chesapeake 26
  Eastport 53
  Fort Worth 129
  Greece 85, 86
  Greenland 71, 85
  Hudson 71
  Iceland 85
  Iran 73
  Manhattan 74-75
  Middle East 73, 86
  Newfoundland 71
  Newport 33
  New York xiii, 106, 136, 137
  Norfolk xiii, 23, 33, 99, 118, 126, 136, 137
  North Africa 73, 85
  Philadelphia xiii, 33, 55, 59, 131, 136
  Providence 74, 85
  Susquehanna 106-107
  Turkey 85
  Washington, D.C. xiii, 23
  Wilmington 28, 29, 55
environment 123
Environmental and Ecological Impact Report on Hurricane AGNES of 1972 125
environmental impact statements xv, 113, 123, 126, 127
Environmental Protection Agency (EPA) 124, 125, 130, 132
EPA. *see* Environmental Protection Agency
Erie Canal 10, 59, 118
Erie Railroad 16
erosion
  beach xv, 43, 51-52, 60, 104, 130, 131
    causes 121-122
  soil 46
Essayons 117

Fallout Shelter Survey 132
Federal Civil Defense Administration 103
Federal Disaster Assistance Administration 107
Federal Emergency Relief Act 53
Federal Power Commission 128, 130
Federal Security Agency 128
Federal Water Pollution Control Act 125
  Amendments of 1972 124, 125, 132
fieldworks, Revolutionary War 3
fill, dumping of xv, 125
Fire Island, NY 121, 122
fish and wildlife, protection of 123, 130
"Five-High" Storm 103-104
floating power plants 74
flood(s), flooding
  Connecticut 46-47
  Johnstown, PA 33
  Mississippi River Valley 36, 44, 47
  New Jersey 105, 106
  Ohio River Valley 36, 47
  Pennsylvania 106
  protection against 132
  Raritan River 46
  Sacramento River Valley 44
  Susquehanna River 47, 106
  Tropical Storm AGNES 106-107, 112-113, 126
  urban 132
flood control xv, 36, 43, 44, 46, 47, 60, 129
  prevention 107, 108-109
  regional 51, 130
Flood Control Act of 1936 47, 49
Fort A.P. Hill, VA 97, 137
Fort Belvoir, VA (formerly Camp Humphreys) 41, 97, 106
Fort Dix, NJ 74, 79, 80, 94, 97
Fort Drum, NY 137
Fort Eustis, VA 80, 94, 97
Fort Hamilton, NY 20
  veterans' hospital 93
Fort Indiantown Gap, PA 74, 137
Fort Lee, NJ 3
Fort Lee, VA 99
Fort McHenry, MD 9, 17
Fort Monmouth, NJ xv, 97
Fort Pickett, VA 137
Fort Totten, NY 20, 21, 137
Fort Washington, NY 3
Fort Worth, TX District, Corps of Engineers 129
fortifications, coastal xvi, 1, 6, 8, 9, 17, 37, 39, 64
Fortress Monroe, VA 19
forts, fortresses 8, 19, 20
Foster Joseph Sayers Dam 112
Frech, Col. Frederick F. 87, 88
Frederick R. Harris, Inc. 98

French Revolution 6
Fundy, Bay of 52-53

General Moultrie 23
General Survey Act of 1824 ix, 14
Georgetown Bridge 33
George Washington University 27
Gibbons v. Ogden 14, 36
Gillespie, Col. George L. 32
Gillmore, Col. Quincy A. 25
Goethals, Maj. George Washington 28
see also Panama Canal
Goose Bay Air Force Base xi, 91
Great Depression, public works in 52, 59
Greece
aid to 86
District, Corps of Engineers 85, 86
aid to 86
Greenland xi, 61, 69-73, 85, 91
Camp Century 89
District, Corps of Engineers 71, 85
early warning system in 89
Thule 86-87
Gribble, Lt. Gen. William C., Jr. 100, 125
Gridley, Col. Richard ix, 3
Groves, Brig. Gen. Leslie R. 75
Groves, Maj. Gen. Richard H. 100, 106, 107, 113, 130
biography 107, 108

Hampton Roads, VA 19, 20, 74, 117
Hampton Roads Energy Company 126
harbor(s)
defenses 8, 20, 39
improvements 29, 81, 114, 117
Harrisburg, PA 106
Harry Diamond Laboratories Complex, MD xv, 97
Hartford, CN floods 47
Hayward, Henry G. A. 120
Health, Education and Welfare, Department of 130
Helmers, McWilliams and 71, 72
Hoboken, NJ 32
Hoffman, Col. George 44-46, 53, 59
Holland, U.S. v. 125
Hoover, Herbert 52
hospitals xv, 74, 93, 113
House Document No. 308 44
Housing and Urban Development, Department of 130
Houston, Texas 129
Howard, Borough of (PA) 112
Hudson District, Corps of Engineers 71
Hudson River
basin x, xi
dredging 23, 32
flooding 46
in Revolutionary War 3

Hurricane AGNES 125-126
see also Tropical Storm AGNES
hurricanes 103, 125-126, 128, 132
hydraulic model of Chesapeake Bay 128

ICBM (Intercontinental Ballistic Missile) 85, 93
Iceland
air bases 91
District, Corps of Engineers 85
Intercontinental Ballistic Missile (ICBM) 85, 93, 132
Interior, Department of 128, 130
interstate commerce clause 36
Iran 61
District, Corps of Engineers 73
Iraq 73
irrigation 36

James River
basin x, xi, 14
flooding 46
Jefferson, Thomas 6
Jersey City, NJ 14
Johnstown, PA 33

Kearney, NJ
bulk mail facility 136
Kelly, Brig. Gen. James L. 100, 114
Kennedy, John F. 132
Kentucky xi
Key, Francis Scott 9
Kill van Kull 32, 117
Koisch, Maj. Gen. Francis P. 128, 130
biography 129
Korean War 85, 86
Kosciuszko, Thaddeus 3

Labrador xi, 91
Lake Champlain, NY xi
Lake Shore Railroad 16
Largo, MD bulk mail facility 136, 137
le Bégue du Portail, Gen. Louis 3
Ledo Road 61
lend lease supplies 69, 74
l'Enfant, Pierre Charles 6
le Prestred de Vauban, Sebastien 2
levees 109, 112
lighthouses 1, 10, 16, 23
Lincoln Memorial 23
Lipscomb, Maj. Gen. Thomas H. 91, 100, 104, 117, 118
Long Island, NY
beach erosion xv
disasters, natural 103
Long Island Railroad 16
Long Island Sound 37
Ludlow, Col. William 32

Lusitania	29, 32
McArthur, Gen. Douglas	61
McHenry, James	10
McWilliams and Helmers	71, 72
"mahogany tides"	125-126
mail, bulk	xvi, 136
Maine	
defenses in	64
regional water studies	128, 131
tidal power project	52-53
Management and Budget, Office of	136
Manhattan District, Corps of Engineers	74-75
work on atomic bomb	74-75
personnel	75
Manhattan Project	74, 75
see also atomic bomb	
Marine Division	59, 74, 119, 120
Marshall, Col. James C.	75
Marshall, John	14
Maryland, state of	
disaster area	106
in AGNES	125
see also Baltimore, Chesapeake Bay	
Massachusetts	131
Matapeake, MD	128
Mediterranean Division	86
Mexican War	1, 17, 20
Middle Atlantic Division	64, 69
Middle East	
bases in World War II	69, 73
District, Corps of Engineers	73, 86
missiles	85, 89, 93, 94
Mississippi River	129
mobilization, support of	xvi
Monroe, James	19
monuments, construction of	23, 24
Morocco, French, air base	91
Morris Canal	14
NAD *see* North Atlantic Division	
Napoleonic Wars	6
NAR (North Atlantic Regional Water Resources Study)	xv, 128, 130
NASA (National Aeronautics and Space Administration)	ix, 129
Natick Laboratories	xv
National Aeronautics and Space Administration	ix, 129
national anthem	9
National Environmental Policy Act of 1969	125
National Parks System	ix
National Road	14
National Shoreline Study	131
navigation	
aids to	1, 10, 14

improvements	23, 129
legislation	123
studies	130
see also River and Harbor Acts	
NENYIAC. (New England-New York Inter-Agency Committee)	128
Newark Bay, NJ, dredging	81
New Castle, DE	10
New England Division	64, 69, 85
New England-New York Inter-Agency Committee (NENYIAC)	128
New England River Basins Commission	130
Newfoundland	
District, Corps of Engineers	71
Province	73
New Hampshire	47, 64
New Jersey	
beach erosion	xv
defenses in	64
natural disaster	103
water needs	131
Newport News, VA	29
Newport, RI District, Corps of Engineers	33
NEWS (Northeastern United States Water Supply Study)	xv, 130, 131
New York Bay	29
see also New York City	
New York Central Railroad	16
New York City	
defenses	64
embarkation facilities	39
harbor improvements	29, 32, 53, 81, 114, 117, 118
NIKE site	94
Port of	x, 23, 32, 114, 117
in Tropical Storm AGNES	106
water studies	131
New York District, Corps of Engineers	xiii, 106, 136, 137
New York, New Haven and Hartford Railroad	16
New York State Barge Canal	32, 55, 59, 118
New York, state of	xi
floods in	46
in Tropical Storm AGNES	106, 113
regional planning	128
Nicholas I, Czar	16
NIKE	85, 94
Nixon, Richard M.	124
Norfolk, VA	
in Civil War	20
embarkation facility	39
harbor	32, 124
NIKE site	94
port	x, 29, 88
Norfolk, VA District, Corps of Engineers	xiii, 23, 33, 99, 118, 126, 136, 137
Normandy, France	61, 64

North Africa
bases in World War II 69, 73
District, Corps of Engineers 73, 85
North Atlantic Coast Deep Water Port Facilities Study 131
North Atlantic Division
Engineering Division of 126, 127
Marine Division of 59, 74, 119-120
Planning Division of 127-128
Procurement 79-80
Real Estate Division of 79
North Atlantic Division Engineer 79
North Atlantic Ferry Route 69, 73
North Atlantic Regional Water Resources Study xv, 128, 130
North Central Railroad 16
Northeast Division 25, 41, 43
Northeastern United States Water Supply Study xv, 130-131
Northampton, MA 50

O'Brien, Col. John J. 79
OCE (Office of the Chief of Engineers) xiii
Office of Emergency Planning 104, 107
Office of Management and Budget (OMB) 136
Office of the Chief of Engineers (OCE) xiii
Officers Candidate Schools, construction of 97
Ogden, Gibbons v. 14, 36
Ohio River, flooding 47
oil
pollution 123, 124
refineries 131
Olney, MD 133
OMB (Office of Management and Budget) 136
Operation Five-High 105
Orange, NJ, Veterans' Administration Hospital 93
Oswego, NY 59

Panama Canal ix, 27, 28, 33
Parker, Brig. Gen. David S. 91, 97, 128
Passamaquoddy Bay 52-53
passive protection measures 74
Peek, Maj. Gen. Ernest D., biography 47-49
Peekskill, NY 93
Penn Central Railroad 119
Pennsylvania, state of 103, 106, 125
see also flood(s), Tropical Storm AGNES
Pentagon 87, 98, 106
permafrost 88
permit system xv, 33, 37, 123, 124, 126
Persian Gulf 73
Perth Amboy, NJ 32
petroleum refinery 126
Philadelphia District, Corps of Engineers xiii, 33, 55, 59, 131, 136
Philadelphia, PA
bulk mail center 136, 137
disaster relief 103

embarkation facility	39
harbor	x, 10, 14, 23, 29, 55
NIKE site	94
Phillipsburg, NJ	14
Picatinny Arsenal, NJ	74, 97
Piedmont Plateau	46
Pilgrim's Landing Monument	24
Pittsburgh, PA, floods	47
Planning Division of NAD	127, 128, 130, 131, 137
plant, floating	120
see also dredges	
Plattsburgh, NY	
Air Force base	91
ICBM site	85, 93
in War of 1812	9
Polar Experimental Station	89
pollution	xvi, 37, 97, 123, 124, 126, 132
port facilities, studies	xv
see also harbor(s), improvements; Baltimore; New York City; Philadelphia	
Portsmouth, VA	126
Post Office Department	133-134
Postal Service. *see* U.S. Postal Service	
Potomac River	x, xv, 46, 47, 128
power generation	
floating plants	74, 120
from flood control dams	110
hydroelectric	36, 46
nuclear	89, 120
requirements	130
tidal power	52-53
power plants	
floating	74, 120
nuclear	89, 120
semiportable	89
Preferential Mail Facilities	136
President's Committee on Water Flow	44
Price Adjustment Boards	78
Price Advisory Board	78
procurement	79, 80-82, 83, 85
profits, control of	75, 78
Providence, RI District, Corps of Engineers	74, 85
Provincetown, MA	24
public buildings	
construction of	23-24
maintenance of	33
Public Law 84-99	113
Public Works Administration	52
public works projects	51, 52
see also canals, erosion, flood control, navigation	
Quartermaster General's Department	39, 65, 67, 75, 79, 83, 98

radar early-warning systems 85, 89, 91, 100
Radford Army Ammunition Plant, VA xvi, 97
railroads
  assistance to 1, 14, 16
  construction 14, 23, 119
Rappahannock River x
Raritan River, floods 46
Reading, PA xv
real estate 79, 81, 94
Real Estate Division of NAD 79, 81, 94
recreation, water xv, 51, 110, 113, 130
  see also dams, flood control, reservoirs
reforestation 46
Refuse Act of 1899
  Section 10 123
  Section 13 37, 123, 124
  Section 17 37
regional planning xv, 127, 128-132, 137
regulation xv, 33, 36, 37, 125
Renegotiation Act 78
Renshaw, Brig. Gen. Clarence R. 87, 88
  biography 98
Rensselaer Polytechnic Institute 6
Republic Steel, U.S. v. 123
Reserve Officer Training Corps 99
reservoirs 47, 109, 110, 113
  see also dams; flood control; recreation, water
resources xv, 36
Revolutionary War ix, 1, 3
Reybold, Maj. Gen. Eugene 67, 69
Rhode Island 131
Richmond, VA 20
River and Harbor Act
  of 1866 23
  of 1899 29, 33, 37, 123
  of 1925 44
  see also Refuse Act of 1899
river development, multipurpose 36
roads, construction of 1, 12
Roanoke River 14
Rochefontaine, Stephen 6
Rockefeller, Nelson A. 118
Rodman gun 19, 20
Rodman, Thomas 19
Roman Empire 2
Roosevelt, Franklin Delano 44, 47, 52, 53, 55, 74
Roosevelt, Theodore 27
Rossell, Brig. Gen. William T. 41
Russia 16
  see also Soviet Union

SAC (Strategic Air Command) 86, 91, 98
Sacramento River Valley, CA 44
St. Lawrence Seaway 120
salinity, effects of 125-126

Sandy Hook, NJ	64
San Francisco, CA	36
Santa Barbara, CA	123
Sayers, Foster Joseph, Dam	112
Schuylkill River, PA	xv, 4
Sea Girt, NJ	122
Secaucus, NJ	136, 137
Sequoia Park	ix
Service of Supply	79, 82, 83
sewage	
pollution from	126, 132
studies	130
treatment	97, 130, 131
shelters, fallout	132
ships	29, 32, 74, 81, 114
see also dredges	
shore(s)	52
see also beach, erosion	
silos, missile	93
Sondrestromfjord, Greenland	71
Southeast Asia, war in	97, 108
Southeast Division	25-26
Southern Railroad	16
Soviet Union	69, 73
Cold War with	85-89
Spacecraft Center	129
Spanish-American War	37
"spoil"	117
see also beaches; dredging; harbor(s), navigation	
Standard Oil, U.S. v.	123
Star-Spangled Banner, The	9
State, Department of	128
Staten Island, NY	32, 117
Stickney, Col. Amos	28, 29
Strategic Air Command (SAC)	86, 91, 98
Sturgis	120
Sturgis, Maj. Gen. S.D., Jr.	vi
supertankers, oil	131
see also harbor(s)	
Susquehanna District, Corps of Engineers	106-107
Susquehanna River	x, xv, 46-47, 106, 112
Suter, Col. Charles R.	28
Tabb, Zabel v.	123
Taft, William Howard	37
Thimble Shoals Channel	122
"308 Reports"	44
Thule Air Force Base, Greenland	86, 87-88, 89, 91
tidal power	51-53
Tioga-Hammond Lake	xv, 113
Tobyhanna Signal Corps Depot, PA	94
Tocks Island Lake	113, 114
Tracking and Telemetry Facility	91
training facilities	97, 137
Transportation, Department of	130

transportation routes 12, 23
Tropical Storm AGNES 106-107, 112-113, 125
Truman Doctrine 86
Truman, Harry 86
Turkey
  aid to, 86
  District, Corps of Engineers 85

unemployment relief 52, 55, 60
Urban Studies Program 131-132
U.S. Military Academy
  Central Concrete Laboratory 74
  as engineering school 1
  expansion xv, 85, 95-97
  hospital 113
  as military academy 6
  see also West Point
U.S. Postal Service xvi, 134-137
U.S. Postal Service Regions 136
U.S. v. Holland 125
U.S. v. Republic Steel 123
U.S. v. Standard Oil 123
utilities 79, 83

Valley Forge, PA
  hospital 74; 93
  Memorial Arch 24
  in Revolutionary War 4
Vermont xi, 47, 80
Veterans' Administration hospitals 93
Vicksburg, MS 74
Vietnam 108, 129
Virginia xi, 125, 128, 131, 132
Virginia Beach xv, 121, 122
VOLAR (Volunteer Army) 97, 99, 137
Volunteer Army 97, 99, 137

Walter Reed Army Medical Center xv, 85, 95, 97
War of 1812 1, 9, 17
warships 37
Washington Aqueduct 16, 33
Washington, DC
  burning 9
  in Civil War 20
  layout 1, 6
  NIKE site 94
  public buildings 23, 33
  water supply xiv, 16, 33, 131
Washington, DC District, Corps of Engineers xiii, 23
Washington, Gen. George ix
Washington Monument 23, 33
waste treatment 130
  see also sewage, pollution
wastewater management 132
  see also sewage, pollution

water resources
- planning 44, 127, 130
- policy 36
- studies 123, 130
- *see also* "308 Reports"

Water Resources Act of 1974 118
Water Resources Council 127
Water Resources Planning Act of 1965 127, 128
water supply xiv, xv, 113, 128
Waterways Experiment Station 74
waterways, navigable
- alternate to rail transportation 36
- improvement of 43, 118
- intracoastal 82
- multipurpose use of 43
- as national highways 14
- protection of xv, 23, 28, 36

Waverly, NY 113
weapons
- antiaircraft 93, 94
- facilities xv-xvi
- *see also* armaments, missiles

weather, surveillance of 71, 107
West Point
- concrete testing at 74
- as engineering school ix, 21
- U.S. Military Academy at xv, 6, 85, 95
- as military post 3
- *see also* U.S. Military Academy

wetlands, 125
Wherry-Capehart legislation 94
Whistler, Capt. George Washington, biography 15-16
wildlife, fish and 123
Wilkes-Barre, PA 106
Willets Point, NY 21, 26, 41
Wilmington, DE District, Corps of Engineers 28, 29, 55
Wilson, Woodrow 27
Woodruff, Col. J. A. 53-54
Works Progress Administration 52
World War I 37-41
World War II 61-75
Wyoming Valley, PA 47, 106

Yellowstone Park ix
Yorktown, VA 4
Yosemite Park ix

Zabel v. Tabb 123
Zanesville, OH 14

US Army Corps
of Engineers
North Atlantic Division